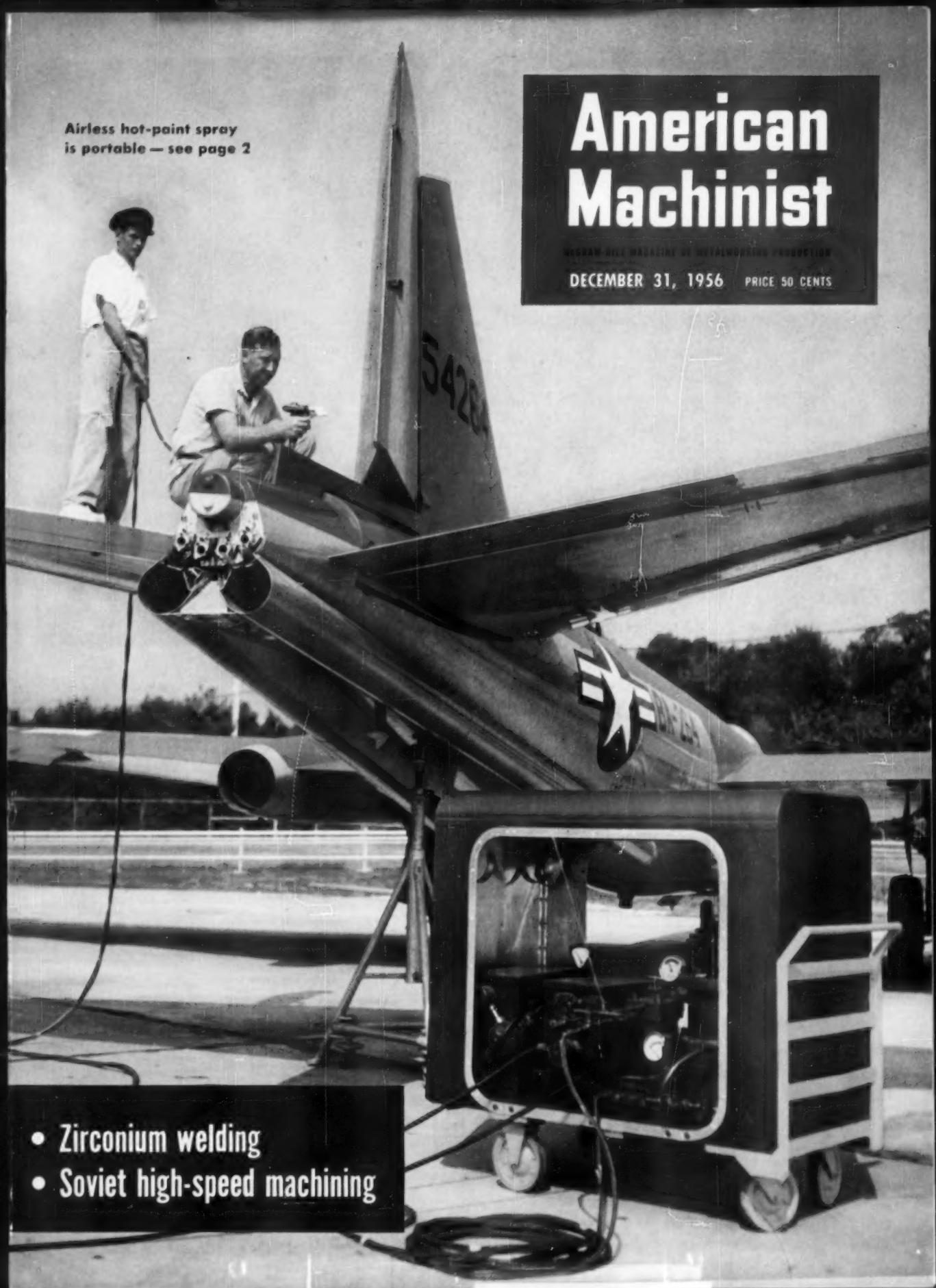


Airless hot-paint spray is portable — see page 2

American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

DECEMBER 31, 1956 PRICE 50 CENTS

- Zirconium welding
- Soviet high-speed machining

LET'S FACE IT!

This special Heald Bore-Matic, with 12-station trunnion type fixture, is designed for precision facing of aluminum automatic transmission valve bodies. Two parts precision faced simultaneously on opposite sides of the fixture. The fixture rotates at approximately ½ rpm and finished parts are unloaded and new parts loaded manually during a 60 degree segment of fixture rotation. With stock removal of .05 inch over the face area and a surface finish of 20 micros or better, this "ferris wheel" Bore-Matic maintains a continuous production of 270 parts per hour at 75% efficiency.

Heald "Ferris Wheel" Bore-Matics put precision facing on a non-stop, high production basis . . . with loading and unloading "on the fly"

WHEN it comes to *precision facing*, Heald Borizing, with a "ferris wheel" type fixture, meets the most exacting requirements for both high production and high precision.

Designed for continuous operation, with non-stop loading and unloading, a multi-station rotating trunnion-type fixture carries the parts between two opposed boringheads which perform simultaneous facing operations on both sides of the fixture.

The loading and unloading are done while the fixture is rotating at a constant speed and can be accomplished easily by manual operation as in the photo above. A foot operated hydraulic clamping control leaves both hands free for this operation.

This specialized precision facing machine illustrates the extreme flexibility of Bore-Matic design and the ability of Heald engineering to solve your precision finishing problems with the most advanced production methods.

IT PAYS TO COME TO HEALD!

HEALD®

THE HEALD MACHINE COMPANY

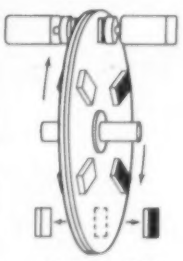
Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

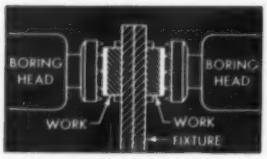
Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

Heald "ferris wheel" Borizing is adaptable to a wide variety of precision facing operations.

BORIZING

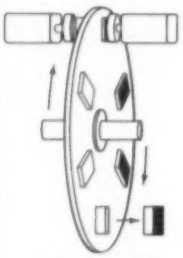


LOADING STATION

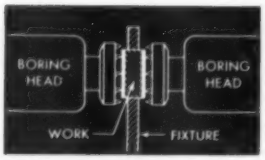


FACING ONE SIDE OF TWO PARTS SIMULTANEOUSLY

BORIZING

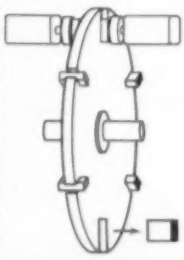


LOADING STATION

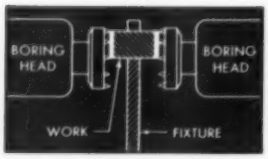


FACING BOTH SIDES OF ONE PART SIMULTANEOUSLY

BORIZING



LOADING STATION



FACING BOTH ENDS OF ONE PART SIMULTANEOUSLY

American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

NEWS REPORT ..

. . . Spot News . . 49
. . . Washington . . 51
. . . Detroit . . 53
. . . Machine Tools . . 55
. . . What's Ahead . . 59
. . . General News . . 106
. . . Names . . 114

Departments...

Letters . . 42
Editorial . . 63
Practical Ideas . . 94
Round Table . . 91
. . . Discussion . . 137
Talking Shop . . 105
New Equipment . . 116

contents for December 31, 1956

VOLUME 100, NUMBER 28

Welding zirconium requires special techniques . . . Fusion welding of an atomic reactor vessel was possible with inert-gas shielding. *By W R Gall, Oak Ridge National Laboratory.* **65**

Fixtures aid pinning of accurate assemblies . . . Solutions to spacing and locating problems in assembling gears, cams, hubs, and couplers. *By Allan Young, Collins Radio Co.* **68**

Turret lathe tapers two angles almost automatically . . . Allison uses solenoids and limit switches to cut taper areas on the OD while boring. *By Ben C Brosheer.* **71**

How to find the cheapest machining method . . . Case histories show how the search for the cheapest method can pay off on small lots. *By Robert T Hook, The Warner & Swasey Co.* **72**

High speed-heavy feed combo boosts Soviet output . . . Feeds up to ½ and ¾ ipr at above normal speeds have raised productivity with normal tool life. **76**

High-rake cutters triple life and speed . . . English tests in milling high-tensile steels show results comparable to high rakes on ordinary steels. **81**

Fire-resistant hydraulic fluids can save $1 million per year . . . Despite higher cost of the fluids, better systems maintenance can reduce costs throughout the hydraulic system as well as avoid fire hazards. *By Charles Emerson.* **82**

Cold extrusion of special nuts cuts costs 50% . . . Kinks in the design of extrusion dies. *By Olaf Stepanek.* **88**

Tandem press line saves five ways . . . Two presses linked with common driveshaft avoid costly dies and a larger press. *By W A Okenfuss, Wagner Electric Co.* **92**

REFERENCE BOOK SHEETS

How to "spread the word" I, II . . . A checklist of the communications methods used by Rockwell Manufacturing Co. **99**

Checklist for design of sub-assemblies . . . Ninieteen pointers for a sub-assembly that is most economical and practical to manufacture. **103**

American Machinist *Chips*

Cover . . .

Hot-paint sprayer used on B-57 jet bombers at Martin. Portable unit draws paint from a standard tank, heats it to 165 F, and pressurizes it to 600 psi, applies it with an airless spray nozzle that atomizes the paint. Method provides a high-gloss finish, requires only two coats instead of the normal three. Further details on page 87.

Fond farewell . . . This issue of *American Machinist* is the last to be published with E J Tangerman as executive editor. Tange started his editorial career as an assistant editor on our staff and later became news editor of the infant *Product Engineering*. After service on a half-dozen other McGraw-Hill magazines, in positions of increasing responsibility, he returned as our managing editor in 1945 and became executive editor in 1950. He leaves now to join *Product Engineering* as executive editor and will succeed to the editorship when George Nordenholt retires next July 1.

Behind these bare facts is a man of remarkable ability, known personally by many of you, and respected by all readers who know him through the pages of *American Machinist*. For the next few issues you will continue to see the articles that he has just completed appearing in our pages, but we know you will want to join with us now in congratulating him on his new responsibilities.

A reader once said that he always opened each new issue of *American Machinist* with a sense of excitement. He didn't know what he would find, but he knew there would be something startling. Tange has been a leader in sparking the sense of urgency on the staff that has made this possible, but he has also managed to develop a staff on which there are many such spark plugs.

Now it can be told . . . Just as Tange is moving gradually into his new post on *Product Engineering*, so has he been moving gradually out of his *AM* job since the appointment of Anderson Ashburn as managing editor. This Chips page, for example, revived by Tange in 1946, and written by him for ten years, passed to other hands last winter.

Under the leadership of Burnham Finney, editor, staff responsibilities have been shifted upward and, to make possible better service to the reader in reporting the growing complexities of metalworking production, we have added two new editors. The last of these vacancies was filled earlier this month. Like all the people who make up our editorial staff, they have been carefully chosen for experience and ability. *American Machinist* will continue more than ever before to bring you the most important developments in metalworking production, and to bring them to you fast, as its editors have done for nearly 80 years. Our plans for 1957 are bigger than ever, but before we turn to them we wanted to pause and wish Godspeed to a valued friend. We are pleased for him, doubly so because he will remain a close associate of ours in his new post.

Coming . . . *AM* for Jan 14 will feature a Special Report showing how to put small-lot production on high-production machine tools and save money in the process. Three articles will deal with the expanding use of shock energy in Metalworking. A foldout insert will provide tables and data for computing time for both primary and second-operation work on screw-machine products. You'll learn about a surprising method of routing superalloys at 2000 sfpm. Our 80th year starts with a banner issue!

ALBERT HAUPTLI publisher

BURNHAM FINNEY editor
E J TANGERMAN executive editor

ANDERSON ASHBURN managing editor
RUPERT LE GRAND senior associate editor

BEN BROSHEER (Chicago) associate editor
H E LINSLEY associate editor
CHARLES D EMERSON associate editor
WM M STOCKER, JR associate editor
JOHN P WRIGHT associate editor
GEORGE H DE GROAT (Detroit) associate editor

ANN McTAGUE assistant editor
TOM JOHNSON assistant editor
GOSTA WERNBERG assistant editor

RICHARD E ROOMAN art director
ANNE PALMER assistant
MATTHEW T HAGGERTY makeup

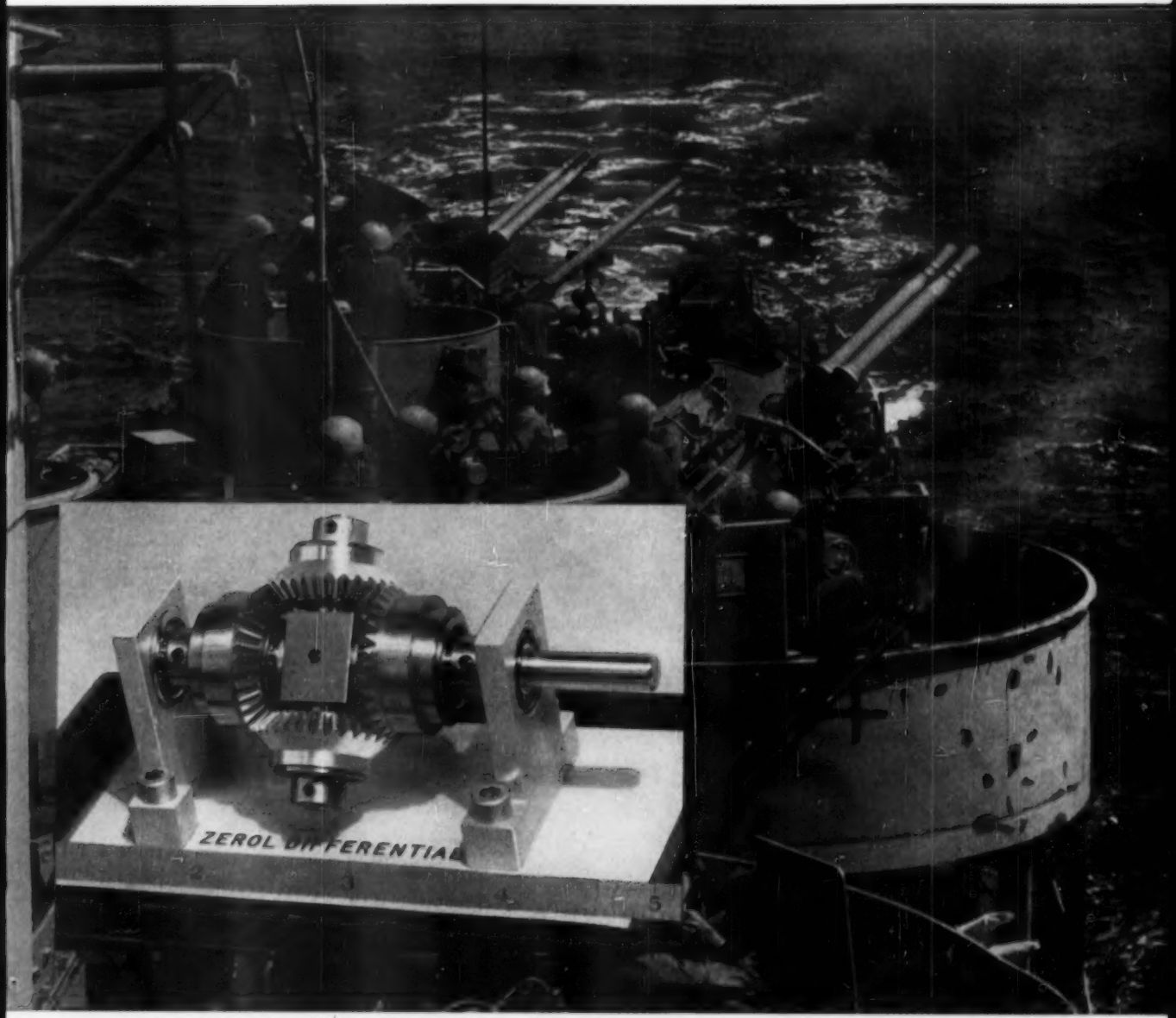
ROBERT SHEETS news editor
HARRY HOMEWOOD Detroit
ROBERT E COCHRAN Cleveland
MARGARET RALSTON San Francisco
JOHN SHINN Los Angeles
HAROLD HOOD Los Angeles
A R HENRY Atlanta
WILLIAM J COUGHLIN London
ROBERT E FARRELL Paris
PETER WEAVER Rio de Janeiro
GERALD W SCHRODER Bonn
DAN KURZMAN Tokyo
JOHN H KEARNEY Mexico City
DOUGLAS GREENWALD statistician
M K MATULIS assistant statistician

DEXTER KEEZER director economics dept
GEORGE B BRYANT, JR chief Washington bureau
JOHN WILHELM editor world news
FRED H COLVIN editor emeritus

GEORGE REPPERT, JR advertising sales manager
RUSSELL T DOUGLAS business manager
CATHERINE C KANE manager, reader service

American Machinist is indexed regularly in the Engineering Index and the Industrial Arts Index

American Machinist, published bi-weekly, with an additional issue in mid-November, by McGraw-Hill Publishing Company, Inc, James H McGraw (1860-1948), Founder.
EXECUTIVE, EDITORIAL, ADVERTISING AND PUBLISHING OFFICES: McGraw-Hill Building, 330 West 42nd Street, New York 36, NY. Donald C McGraw President; Paul Montgomery, Executive Vice President; Joseph A Gerardi, Vice President and Treasurer; John J Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B Smith, Vice President and Editorial Director; Joseph H Allen, Vice President, Director of Advertising Sales; J E Blackburn, Jr, Vice President and Circulation Director.
SUBSCRIPTIONS: Address correspondence to American Machinist-Subscription Service, 330 West 42nd Street, New York 36, NY. Allow one month for change of address. Subscriptions are solicited only from production executives and engineers in the metalworking industries. Position and company connection must be indicated on subscription orders.
Single copies, 50c. Subscription Rates—United States and possessions, $5 a year, $8 for two years, $10 for three years. Canada $7 for one year, $11 for two years, $14 for three years. Other Western Hemisphere and the Philippines, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Second-class mail privileges authorized at New York, NY.
Copyright 1956 by McGraw-Hill Publishing Co, Inc—All Rights Reserved.



Official United States Navy Photograph

When your fine pitch gears *must be accurate*

When you work with fine pitch gears like those in this naval fire control unit differential, tolerances are critical.

Tooth-to-tooth accuracy is extremely important to permit the guns to be sighted precisely on target.

So where accuracy is really critical in the gears you make, Gleason can help you three ways:

1. Machines that cut or grind any fine pitch gear

You can produce any fine pitch gear—spiral bevel, hypoid, Zerol®, or Coniflex®—exactly and economically with any of five Gleason machines.

Three automatic gear-cutting generators cover the entire field of cut fine pitch bevel gears up to 4½" diameter. Two automatic, wet-type grinders are available for this same range of work and produce the ultimate in accuracy. All five work to your most rigid specifications.

2. Machines that test gears thoroughly

The Gleason No. 104 Hypoid Tester, for example, checks running qualities, tooth spacing, and concentricity of gears. It records test results on paper so that you have a permanent record of the total tooth-to-tooth composite error.

3. Engineering services

Gleason engineers are ready at all times to help you with any phase of the design and manufacture of fine pitch gears.

Simply write or phone for prompt assistance on any of your fine pitch gear requirements.

Send for these bulletins:

No. 2A Straight Bevel Coniflex® Generator
No. 103 Straight Bevel Coniflex® Generator
No. 2 Hypoid Generator
No. 105 Straight Bevel Coniflex® Grinder
No. 7 Hypoid Grinder
No. 104 Hypoid Tester

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

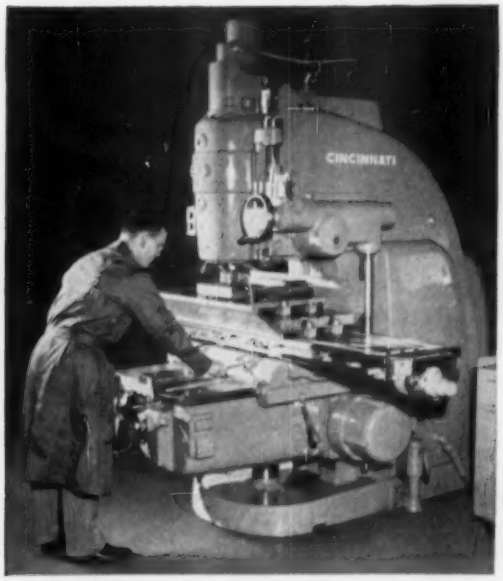
1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.

For Quickest Action

in Cutting Metal and Costs

A high cubic removal job (¼" depth of cut, 19 ipm feed) . . . milling the sides of heavy machine tool part on a new CINCINNATI® No. 5 Plain Dual Power Dial Type Milling Machine

NEW CINCINNATI HIGH POWER and DUAL POWER DIAL TYPE MILLING MACHINES



Power draw-bar attachment reduces the cost of this 12-operation job on No. 4 Vertical Machine

Front view of the setup shown at the left

Primarily, you're cutting costs when you step up cubic removal of metal. And you have plenty of opportunity to remove metal as rapidly as the work and fixture will permit when you assign the job to a new CINCINNATI® High Power or Dual Power Dial Type Milling Machine. These new knee types are tops in cutting capacity; tops in easy, convenient operator control; tops in low maintenance expenses. You'll be interested in the "vital statistics."

Sizes	No. 3	No. 4	No. 5	No. 6
Styles	Plain Univ. Vert.	Plain Univ. Vert.	Plain *Univ. Vert.	Plain Vert.
Table travel	34"	42"	50"	60"
24 Spindle speeds	16 to 1600 rpm	14 to 1400 rpm	14 to 1400 rpm	14 to 1400 rpm
32 Feeds	⅜ to 90 ipm	⅜ to 90 ipm	⅜ to 90 ipm	⅜ to 90 ipm
Motor drives:				
Spindle (H.P.)	20 hp	25 hp	25 hp	25 hp
(D.P.)	30 hp	50 hp	50 hp	50 hp

*No. 5 Universal available in High Power Machine only

Columns of figures are dry reading; more interesting are the cost-reducing possibilities of the many High Power and Dual Power features. For example, horizontal machines are equipped with Dynapoise overarms to reduce self-excited chatter . . . plain and vertical machines are equipped with automatic table cycles . . . full power to the spindle with independent feed drive motor . . . single lever, power selection of speeds and feeds. Many additional features and advantages are outlined in new catalog No. M-1917. Write for a copy; or look in Sweet's for brief data.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

POWER to build delivered

Lorain-56 Shovel-Crane is 1¼ yard shovel, 25-ton crane, or 30-ton crane as desired, features torque converter to absorb working shocks and stresses, 2-lever air controls for easier operation.

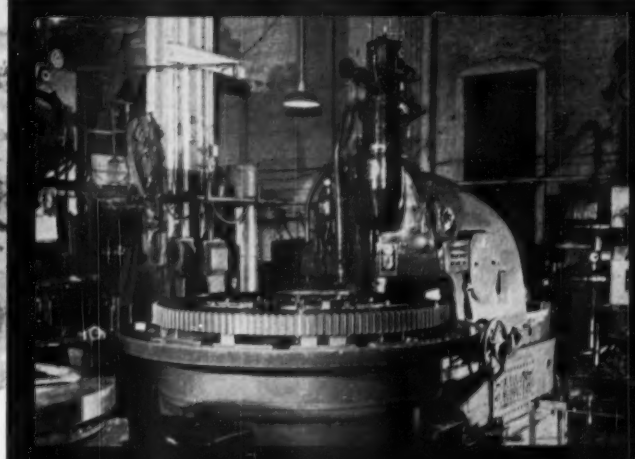
Lorain Moto-Cranes* combine speed, power and versatility available in a range of lifting capacities from 7 to 75 tons. Multiple speed transmission, multiple big tires provide exceptional off-road mobility.

THE PRECISION LINE

Fellows

*Reg. U.S. Pat. Off.

America's Highways...
by FELLOWS-CUT GEARS



120-Inch Gear Shaper set-up for 138-tooth cast steel gear of 290-330 Brinell, 5" face width, 1.783 C.P., 1.180" total depth of cut. Four cuts—1181 min. approx.

100-Inch Gear Shaper cutting 73-tooth internal gear, 3½" face width, .8235 D.P., 1.007" depth of cut. Material—steel casting 197-235 Brinell. One cut—320 min. approx.

The machines that move mountains of material for America's highway programs demand good, rugged, smooth running gears that will transmit, without failure, the many tons of force required.

The well known Thew Shovel Company of Lorain, Ohio is one of the major construction equipment makers that use Fellows machines to produce these gears. The largest Thew-Lorain gears require the largest capacity Gear Shapers in the Fellows Line, the 100-Inch and the 120-Inch.

These two Gear Shapers are designed to take heavy cuts at coarse feeds on spur or helical gears. Capacities: 28" to 100" for externals and 46" to 100" for internals on the 100-Inch; 28" to 120" for externals and 46" to 120" for internals on the 120-Inch. Maximum face width on each is 8".

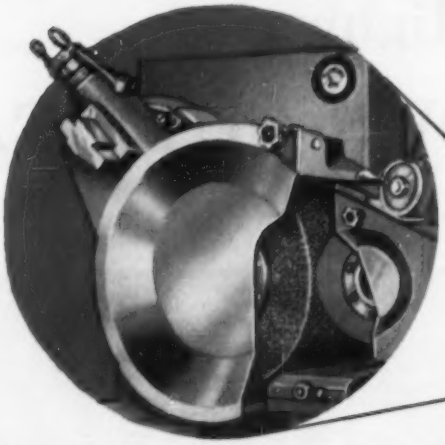
For *full* information about the complete Precision Line of cost-cutting Fellows Gear Production Equipment get in touch with your Fellows representative. Write, wire or phone any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N.J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

Gear Production Equipment

VAN NORMAN

New

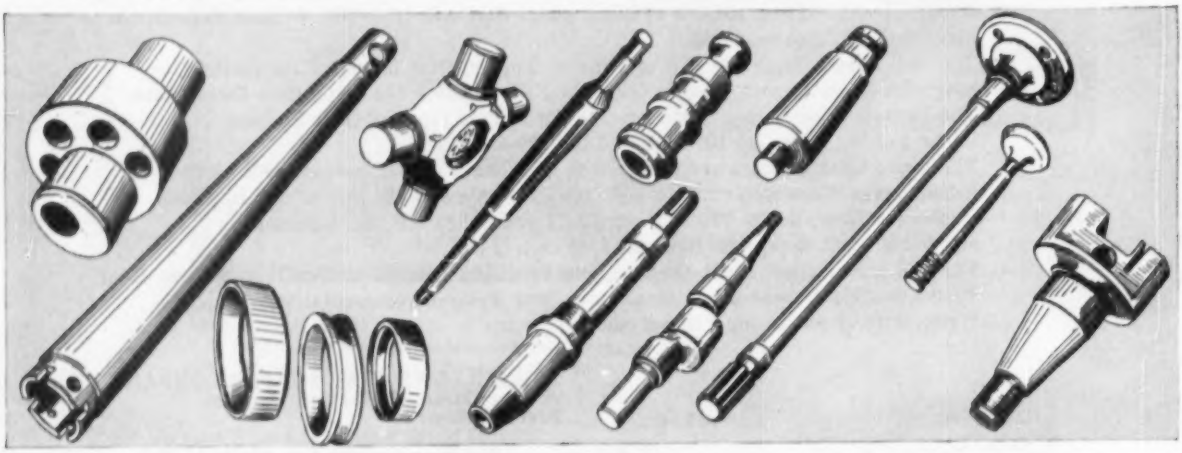


The new Van Norman No. 2C Grinder is *engineered* for fast, accurate, economical grinding of parts. Incorporated in the many outstanding features is the *15 HP* main drive motor which provides ample power for every grinding job. Couple this with the totally enclosed rugged grinding wheel spindle and you get close-tolerance smooth finishes plus chatterless, trouble-free operation.

Compare These Outstanding Features

- Hard chrome plating of regulating wheel slide after hand scraping, preserves original factory built-in accuracy.
- Grinding wheel and regulating wheel spindles are of a unit type construction . . . totally enclosed with double-row super-precision bearings, sealed and lubricated for life, assuring chatterless trouble-free operation.
- Spindles require no warm-up period, eliminating "creep" which has always been a problem in grinding operations.
- Infinitely variable regulating wheel drive.
- Totally enclosed fan cooled, dynamically balanced 15 HP main drive.
- Independent hydraulic wheel truing devices for each wheel.
- Fine hand wheel adjustment on diameter of work piece.

Phone, wire or write for full details on the new Van Norman No. 2C Centerless Grinder.



Grind Parts Like These Accurately, More Economically

VAN NORMAN MACHINE

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

No. 2C Centerless Grinder

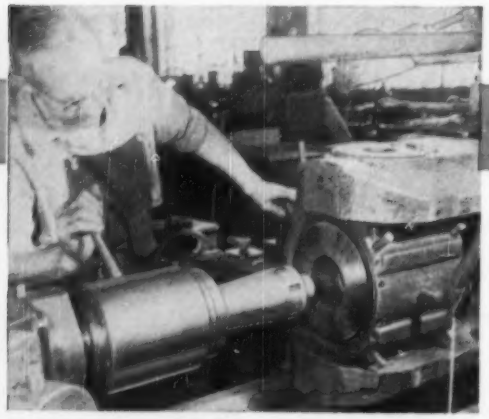
...Features 15 HP Main Drive

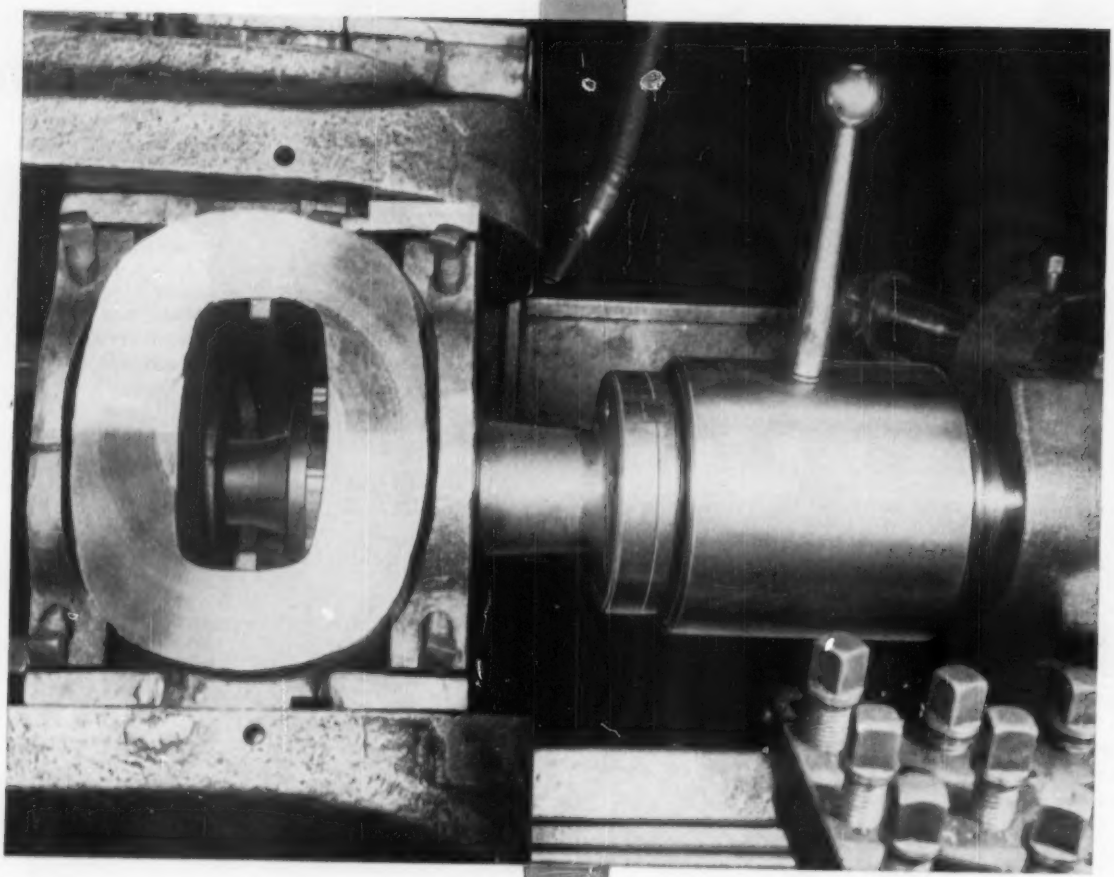
Assuring Precision, Close-Tolerance Grinding

VAN NORMAN NO. 2C
Capacity: 0" to 4¾"
Grinding wheels available: 24" x 4" x 12"; 24 x 6" x 12"; 24" x 8" 12"
Regulating wheels available: 12" x 4" x 5"; 12" x 6" x 5"; 12" x 8" x 5"
Automatic cycling and gauging available.

Don't wait . . . for extra profits install a Van Norman Machine now!
They are available on many purchase plans — Outright sale . . . Purchase on conditional sales contract up to 5 years . . . Pay as you depreciate . . . See your dealer or write Van Norman Company. Conditional Sales Contracts not available to Export.

COMPANY **SPRINGFIELD 7, MASSACHUSETTS**





tapping threads from inside out

Seats are *tapped* in gate valves by using LANDIS Valve Taps, even though the diameter of the thread exceeds that of the valve port.

The use of a 6VB LANDIS Valve Tap at the Kerotest Mfg. Co., Pittsburgh Pa., illustrates the method and results of this operation. Specifications require 5" 12-pitch UN threads cut ⅝" long to Class 3 fit in 4" steel body castings.

Even though the seat thread diameter exceeds that of the valve port, the "collapsing action" of the tap (which withdraws the chasers into the head) gives sufficient clearance to move the tap into the port. The chasers are then expanded (from ¾" on smaller taps to 2" on larger sizes) within the valve body, and threads are tapped outward as the lathe carriage is moved rearward by the leadscrew. (Note: Special chasers are available on certain of these operations that enable threading the opposing seats without removing the tap from the valve body.) After completing the thread, the tap is again collapsed and withdrawn.

Threads are cut at 12 R.P.M., and 100 threads are completed before regrinding the chasers. Each set of chasers produces an average of 700 pieces, excellent life with the short throat or chamfer required in this particular operation. Operation of the tap is by hand, and the valve body must be indexed 180° to thread the opposing seat.

LANDIS Valve Taps are available for diameters from 2" to 24", and each tap body can be equipped with tap heads of various sizes to thread many different seat diameters. Note that these taps feature a tapered head, of great value where valve seats are inclined at an angle to the port opening. This allows tipping the valve body into threading position after the tap has entered the port. More information on request—please send drawings.

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT CUTTING • TAPPING • GRINDING • ROLLING

LANDIS *Machine* COMPANY

437-C. WAYNESBORO • PENNSYLVANIA • U. S. A.

Savings in setup and operating time

versatile/economical/compact

Ideal for toolroom or short runs where small parts require precision accuracy and fine finishes

Landis 10" x 20" Universal Cylindrical Grinder

LANDIS

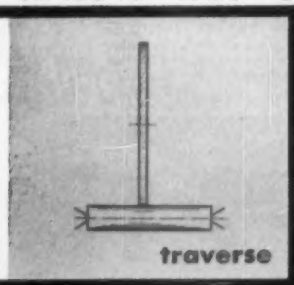
precision grinders

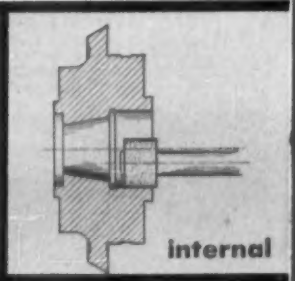
lower grinding costs on small parts

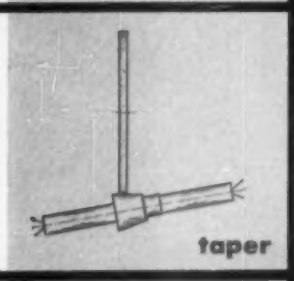
condensed specifications

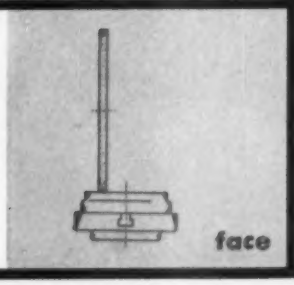
Maximum work swing	10¾"
Length between centers	20"
Diam. standard grinding wheel	10"
Wheel drive motor	1 hp.
Work speed range	90 to 600 r.p.m.
Net weight, including elec. equip.	4100 lbs.

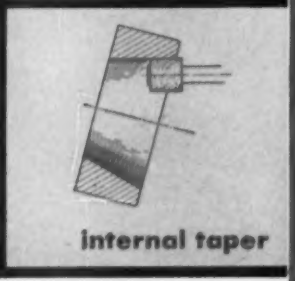
grinding operations on the 10" x 20" universal



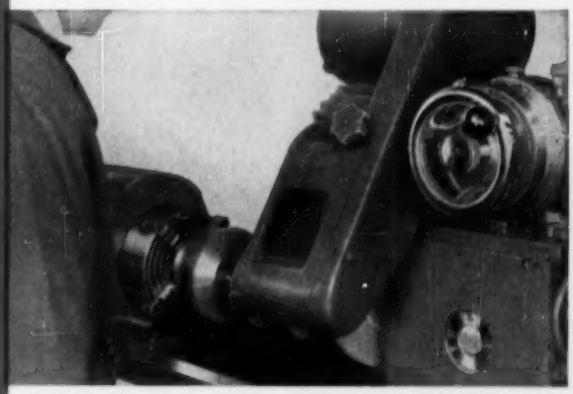




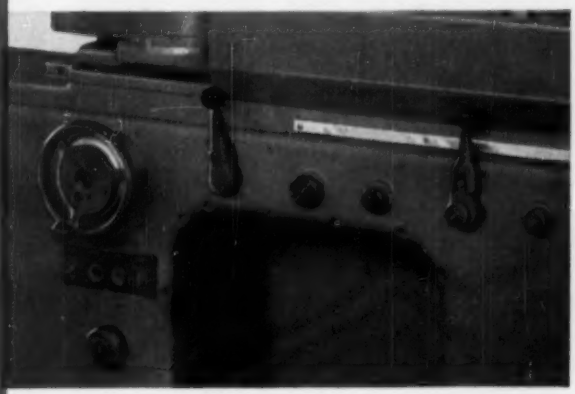




Eye level wheel feed for fast setup and operation



Internal grinding with modern swing-back fixture



Controls grouped for easy setup and operation.

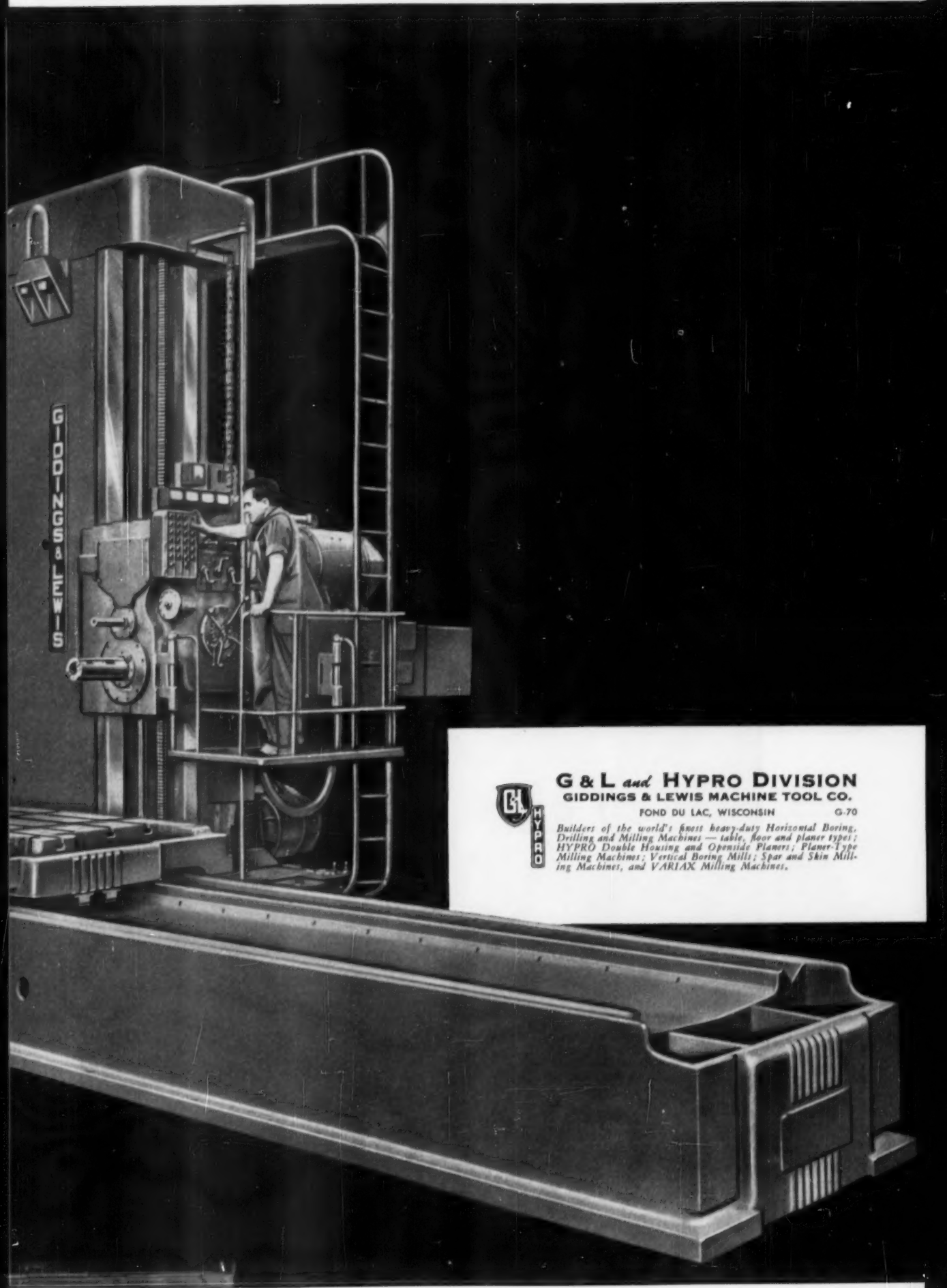
LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

GIDDINGS & LEWIS
(MODEL 560-P)
PLANER TYPE
horizontal boring, drilling and milling machines

More production at lower cost is the best reason why you'll find G&L Planer Type horizontals on the job — day-in and day-out. They're available in various sizes and a wide range of feeds and speeds . . . spindle sizes 5" thru 14" dia. . . . . motor drives 40 to 150 hp . . . and furnished with accordion-type way guards. The larger machines can be supplied with electric tracer control and heavy-duty spindle underarm support.

For more information on Planer-Type horizontals, see your nearest G&L representative, or write direct.

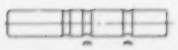
LITERATURE AVAILABLE:
For complete specifications on 50 Series Planer Type horizontal boring, drilling and milling machines, write for Bulletin No. 50-P.



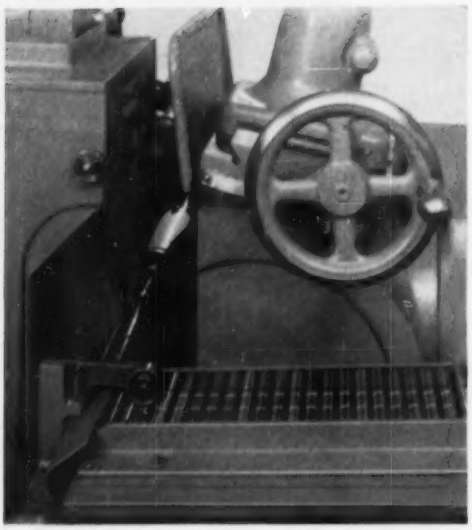
G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN G-70

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Milling Machines.

CINCINNATI



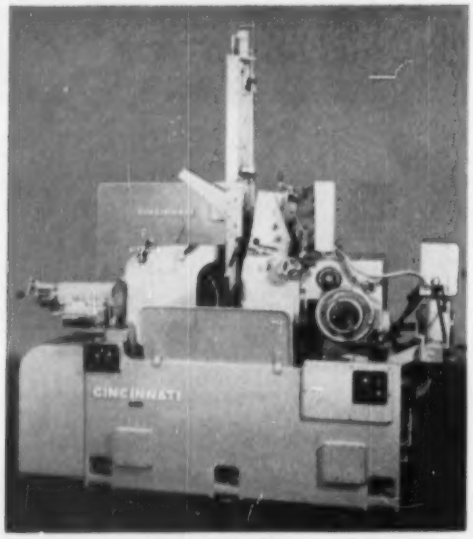
Pump shafts. A magazine type work loading fixture and automatic infeed attachment help to reduce the cost of grinding bearing grooves. CINCINNATI FILMATIC No. 2 Centerless Grinder.



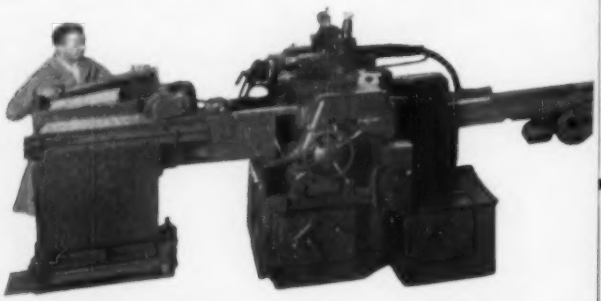
...and Cincinnati Centerless

can reduce costs

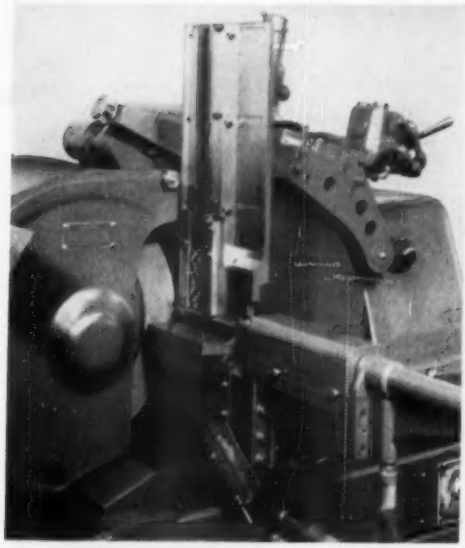
Some old, some new... but all of them show various degrees of automation designed and built for CINCINNATI® Centerless Grinders by Cincinnati grinding specialists. These men can draw upon 33 years' experience in this type of work. And you can be sure that they will give you the benefit of the most advanced thinking in



Universal joint spiders. An ingenious mechanism combines loading and transferring the parts from one pair of wheels to the next. Four diameters are automatically ground each cycle. CINCINNATI FILMATIC No. 2 Centerless Grinder.



CINCINNATI



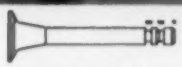
Twist drills. Nine years ago, when Cincinnati grinding specialists equipped this CINCINNATI FILMATIC No. 2 Centerless to automatically grind twist drills, Cincinnati already had more than 20 years' experience in developing high production centerless grinding methods.

Automation

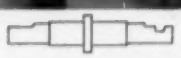
in your shop, too

centerless grinding methods. That's one of the big reasons why it will pay you to consider Cincinnati first. Only Cincinnati can give you the advantage of long experience and a choice of six sizes of centerless grinders. May we hear from you?

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO



Automotive valves. Two accurately spaced grooves and two bevels are ground in the stem, in one operation, from the solid. Automation features include cycle time stabilizer; automatic truing; cam regulating wheel. CINCINNATI FILMATIC No. 2 Centerless Grinder.

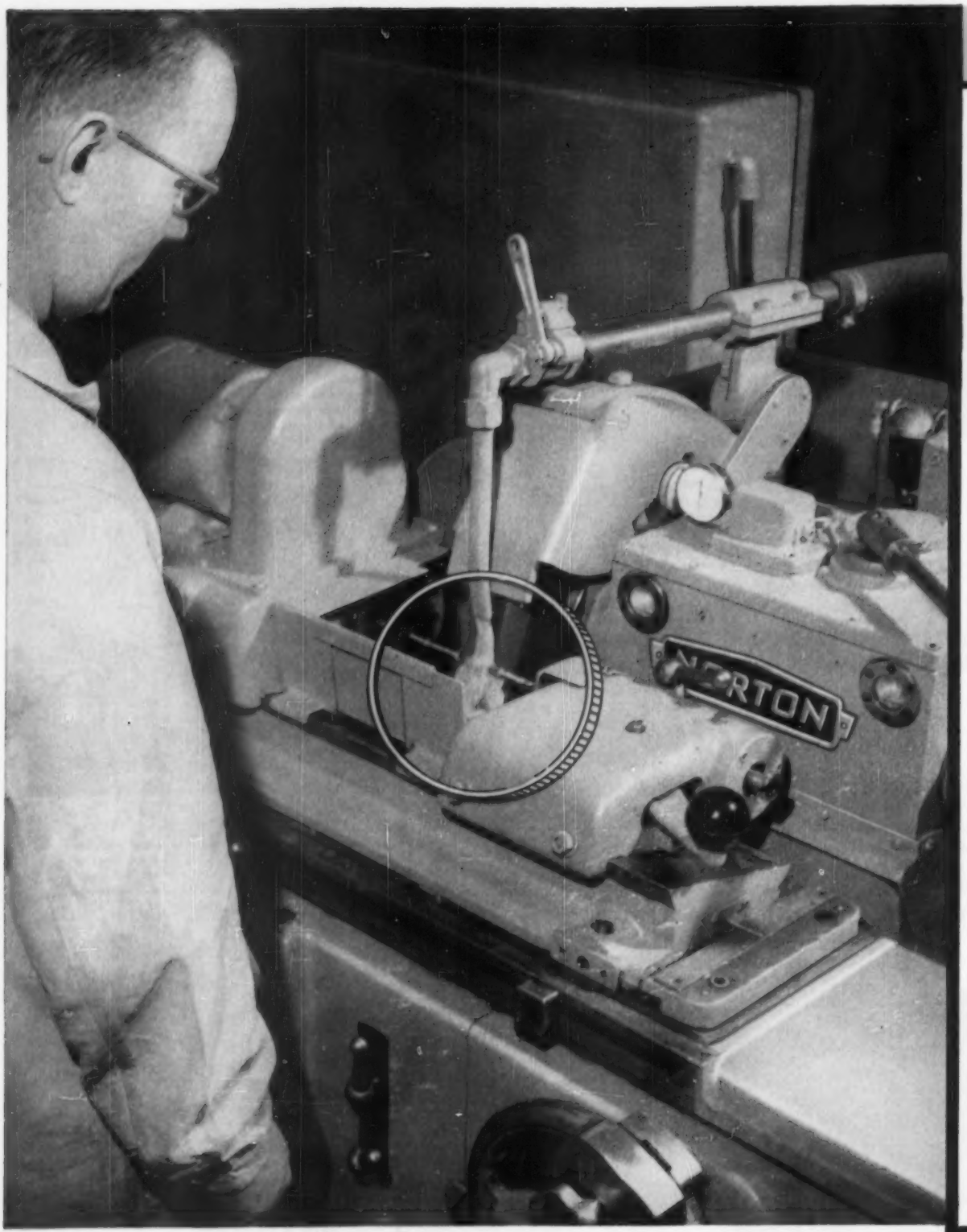


Track roller shafts. Two diameters with heavy and variable amounts of stock are automatically ground on three sizes of these parts. CINCINNATI FILMATIC No. 3 Centerless, equipped with automatic loading fixture and electro-hydraulic automatic infeed attachment.

Rocker arm shafts are loaded into the hopper at the left and transferred by conveyor from one CINCINNATI FILMATIC No. 2 Centerless to the next, and finally through the CINCINNATI FILMATIC Centerless Lapper at the far right.

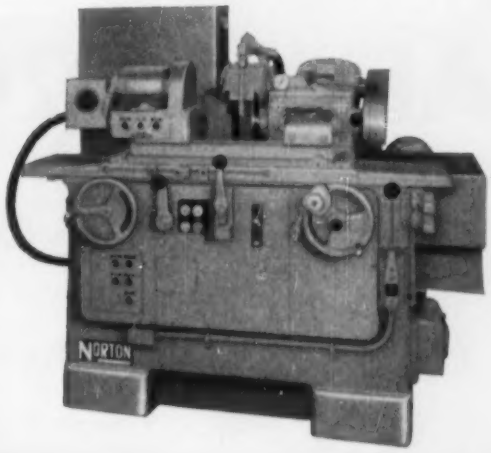
FILMATIC

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES



HIGH PRECISION PLUS HIGH PRODUCTION. Long-lasting accuracy is built into the 4" x 18" Type CTU cylindrical grinder — together with many Norton "Touch of Gold" features that reduce operators' duties and speed production. Remember: only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost.

Norton 4" x 18" Type CTU cylindrical grinder



Here's a cylindrical grinder you can get as either a Plain Machine for traverse work, or as a Semiautomatic for plunge operations.

Either way you get faster, more accurate, more profitable grinding of a wide variety of small parts. Because either way the 4" Type CTU's Norton-developed features bring a new ease of operation for your men — and a new high in production quality and quantity for *you*.

For example, there's the extremely rugged wheel spindle unit that assures enduring precision in jobs ranging from heavy stock removal to fine finishing. Then there are optional profit-boosting extras like the new SWIVALIGN Dual Electric Indicator for measuring swivel table adjustment, and an Automatic Wheel Truing Device.

Get All the Facts

on how this fast, accurate grinder can add the profit-boosting "Touch of Gold" to your grinding operations. See your Norton Representative, or write direct for Catalog No. 531. And ask about the Norton Lease and Purchase Financing Plans that enable you to modernize while conserving your capital. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

To Economize, Modernize with NEW

NORTON

GRINDERS and LAPPERS

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives, Grinding Wheels, Grinding Machines, Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives, Sharpening Stones, Behr-cut Tapes

District Offices: Worcester • Hartford • New York Area
Teterboro, New Jersey • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5, Ontario

ARMSTRONG

Quality TOOLS

More than meets the eye

There are extra values in ARMSTRONG TOOLS that become apparent only with use.

TOOL SENSE— convenience in use — the most efficient *"tool approach"* built into ARMSTRONG Tool Holders; the balance and *"feel"* of an ARMSTRONG Wrench; the *rigidity* of ARMSTRONG "C" Clamps; the extra *toughness* of ARMSTRONG Lathe Dogs and Eye Bolts; the universal *adaptability* of ARMSTRONG Set-up and Hold-down Tools — the evidence of "tool sense", the understanding of each tool's requirements.

STRENGTH — built into each individual ARMSTRONG TOOL is a safety factor of extra *strength* — *strength* beyond any need, the inherent strength of specially selected materials enhanced by proper heat treatment and hardening.

UNIFORM QUALITY — the uniform quality made possible by modern manufacturing methods, in a specially-built plant equipped with every needed quality control. The name ARMSTRONG with the Arm-and-Hammer Trade Mark is universally recognized as a guarantee of finest quality.

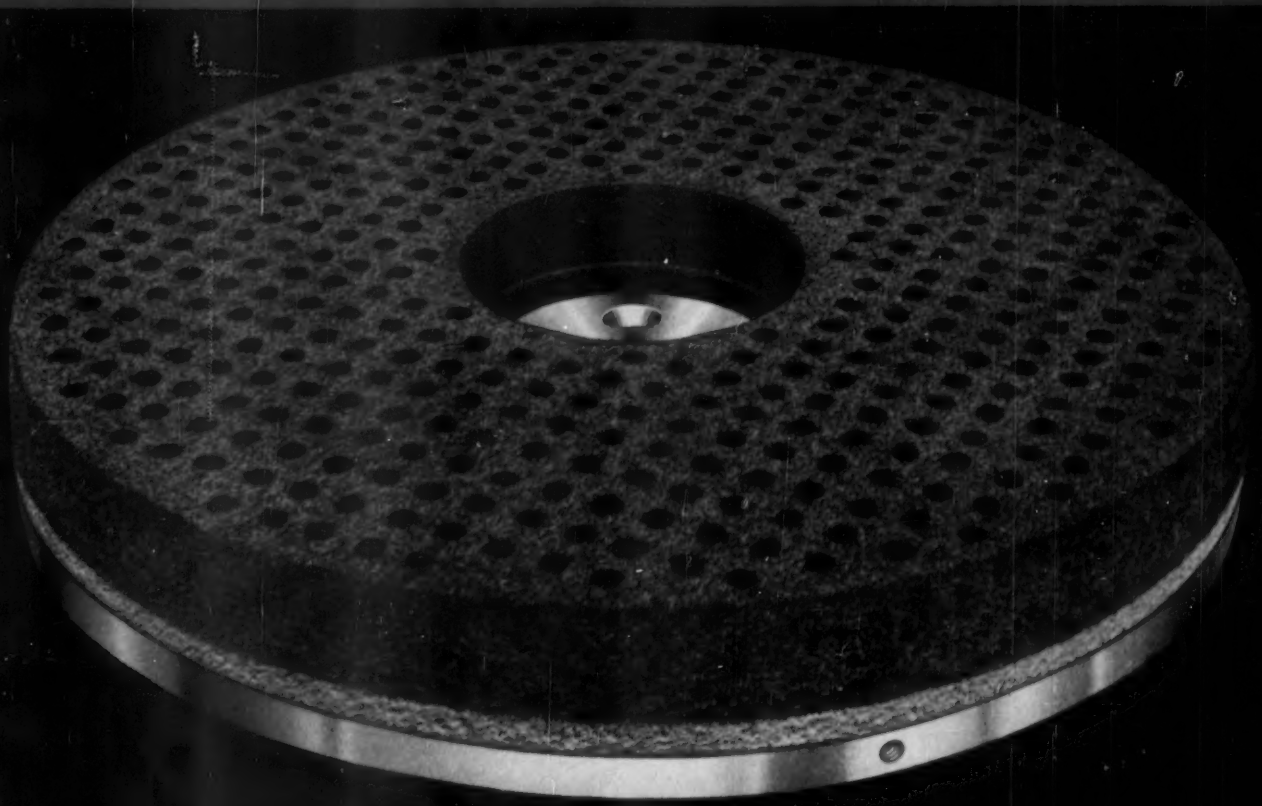
ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5215 WEST ARMSTRONG AVE. • CHICAGO 30, ILLINOIS

Grinds 2,000,000 pieces per disc

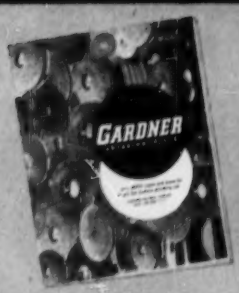
Cool cutting deep corrugated Gardner disc gives low unit grinding cost



Stock Removal: .007"

Abrasive Disc Used: Gardner YELLOW RIM® 12" x 1" x 5"

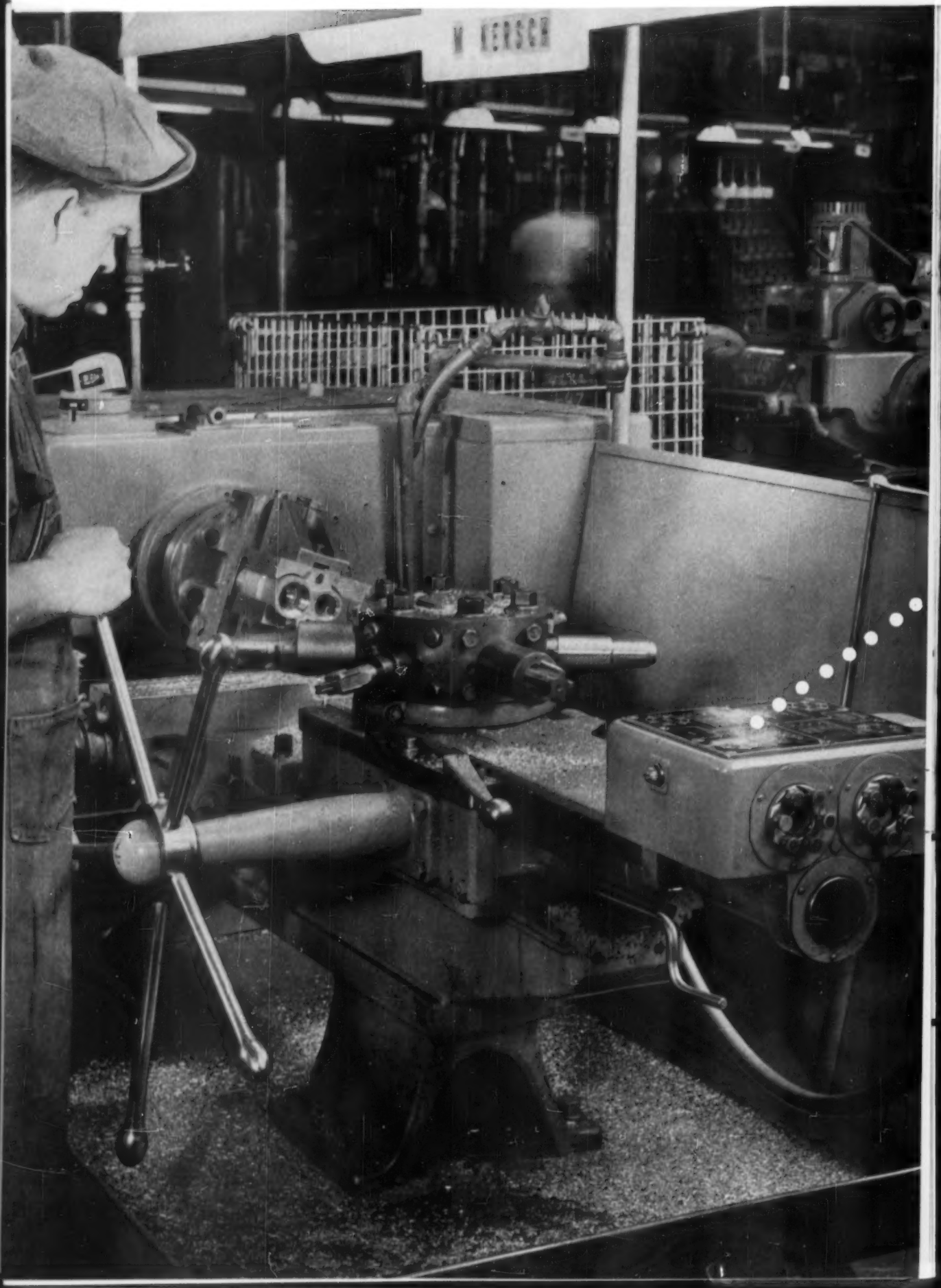
New Abrasive Disc Catalog, AC-55, summarizes factors important in selection of best disc for your particular grinding job. Write for your copy.



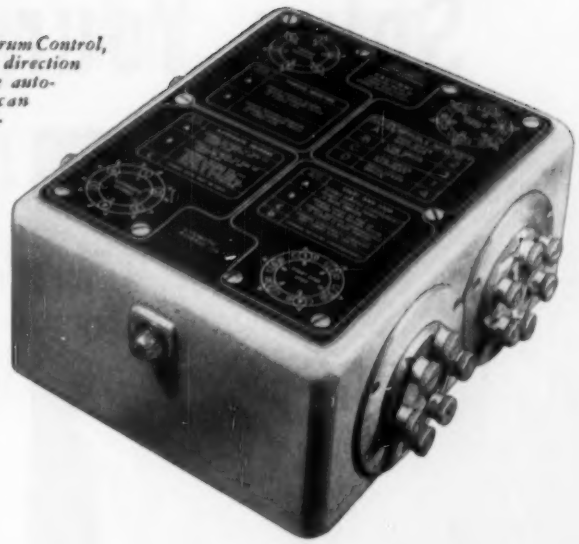
GARDNER

abrasive discs

BELOIT, WISCONSIN


W KERSCH

By simply presetting this Electro-Cycle Drum Control, spindle speed, starts and stops, spindle direction and reverses for each turret face are automatically controlled. Your operator can quickly handle large volumes of precision work, without tiring himself on time-consuming manual operations.



Warner & Swasey Electro-Cycle® Turret Lathe boosts production 30% at Decatur Pump Co.

Automatic lathe operation, provided by the Electro-Cycle principle, substantially reduced both handling time and operator fatigue. Immediately, production increased and profits improved.

This nationally-known producer of "Burks" Super Turbine and Centrifugal pumps, located in Decatur, Illinois, recently replaced a conventional geared head turret lathe with a new Warner & Swasey No. 3 Electro-Cycle. Immediately, their production of pump jet bodies—machined from bronze castings—increased 30%.

Using his new Electro-Cycle, the operator easily produced more finished parts per shift because:

- **Workpiece handling was cut to a minimum.**
- **Fatigue was substantially reduced.**
- **Automatic operation eliminated all time-consuming hand work.**

On both ferrous and non-ferrous materials, Electro-Cycles are daily turning in equally impressive records in machine shops all over the nation. Why not ask our Field Representative to show how they can help increase your production —and profits, too.

® Reg. U. S. Pat. Off.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

Solve Your Inspection Taft-Peirce

No other air gage offers you the speed, range and versatility of a T-P CompAIRator. Look over these features and applications and see for yourself — then discuss your specific gaging problems with your Taft-Peirce sales engineer. He'll show you how to save time and money with Taft-Peirce CompAIRator Air Gages.

T-P COMPAIRATORS GIVE YOU THESE 5 ADVANTAGES

1. Instant Reading. No flutter . . . no creep . . . no appreciable time lag. Readings are virtually instantaneous even when extension hoses thirty feet long separate gaging member from CompAIRator.

2. More Versatile. No other air gage matches the accuracy over such a wide variety of applications . . . from simple diameters to simultaneous checks of such relationships as concentricity, squareness, and center distance.

3. Velocity-type Circuit. Venturi principle offers 3 advantages — accurate gaging of ID's as small as .055″ . . . magnification change simply by substituting one part and dial face . . . and linear readings.

4. Wider Tolerance Range. One basic CompAIRator with suitable gaging members and venturis, can check any specific tolerance range from .0001″ to .125″.

5. Gages Rough Surfaces. Contact type members allow precision gaging of parts with surface finishes beyond 50 micro-inches, rms . . . retain the self-positioning advantages of direct air gaging.

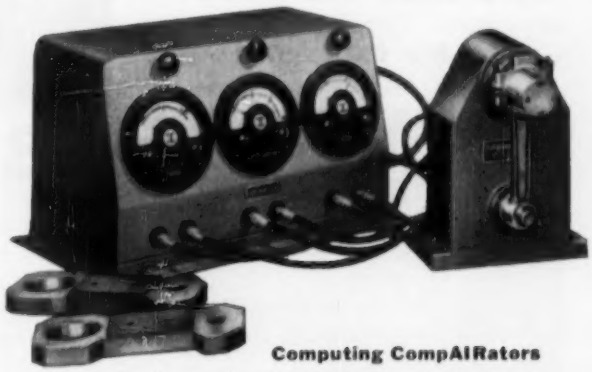
THE TAFT-PEIRCE

Problems by Air with CompAIRator Air Gages...

THERE'S A T-P COMPAIRATOR FOR EVERY INSPECTION NEED

CompAIRators

Available in single, double, or multi-dial units. Can be used with standard air plugs (for through-holes, counter-bores, or blind holes), air rings, and air snap gages — directly attached to cabinet, or to extension hose. Contact type members permit air gaging of rough surfaces. Special fixtures designed and built to order.

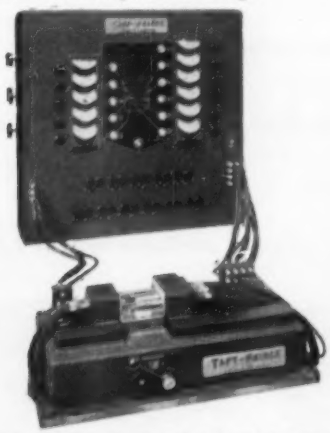


Computing CompAIRators

For measuring such relationships as squareness or center distance, a Computing CompAIRator eliminates making two separate measurements and a calculation. Does the whole job — measures, computes, and indicates the result instantly on a single dial. 3 dial unit above replaces 6 ordinary indicators.

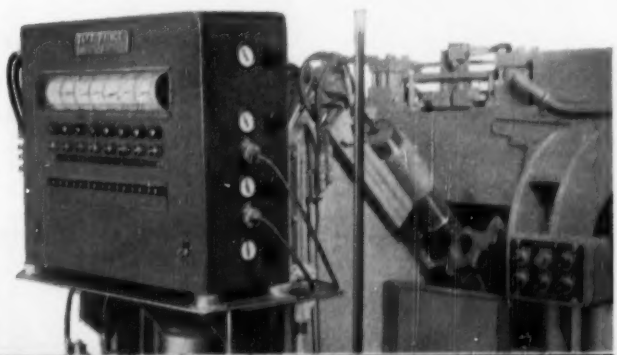
Air-Electric CompAIRators

For rapid inspection of a number of dimensions. Lights indicate any dimension out of tolerance. Exact reading can be then taken from proper dial face. Compact angular mounting of dials, either horizontally or vertically, speeds and simplifies reading.



Automatic CompAIRators

Easily incorporated into production lines where maximum speed of inspection is required. Automatically checks parts, rejects off-size work. Can be built directly into high production machine tools to actuate size control mechanism.



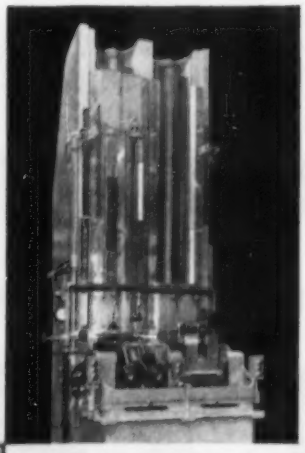
MANUFACTURING CO.

WOONSOCKET, RHODE ISLAND

T P

T-P means Top Precision

We know a
GOLF CLUB maker
who used his head...
by converting to



LAPOINTE-BROACHING

he out-played his competition and copped the championship!

He was in a trap. Not really stymied, you understand, but he needed help. And he wasn't a duffer, either — not by a long shot! Actually, one of the best in the business.

But he needed a lift, and he needed distance. Well, you know how it is in golf: you change your grip, you change your swing, you change your stance, you change your clubs. When he finally changed his clubs — *his tools* — and converted to Lapointe-Broaching from his former process . . . he got both lift and distance! The lift was the *amazing rise in rate of production;* the distance was the *extra "carry" his shop obtained in flattening out his costs.*

By Lapointe-Broaching his irons, he can now offer the golfer absolute uniformity — *truly matched sets* based on a scientific and exact mathematical formula of weight coordination that makes *every club in the set swing and feel the same.*

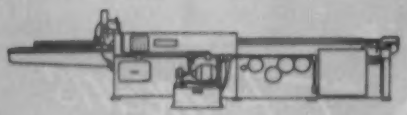
Lapointe-Broaching can help improve the production score in your own plant. Why not follow through on this, and ask a Lapointe Field Engineer to show you how Lapointe-Broaching can give you a birdie — or maybe an eagle!

THE LAPOINTE MACHINE TOOL COMPANY

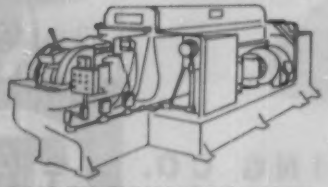
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

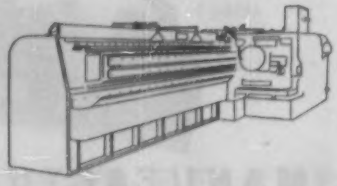
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . *available only at* LAPOINTE



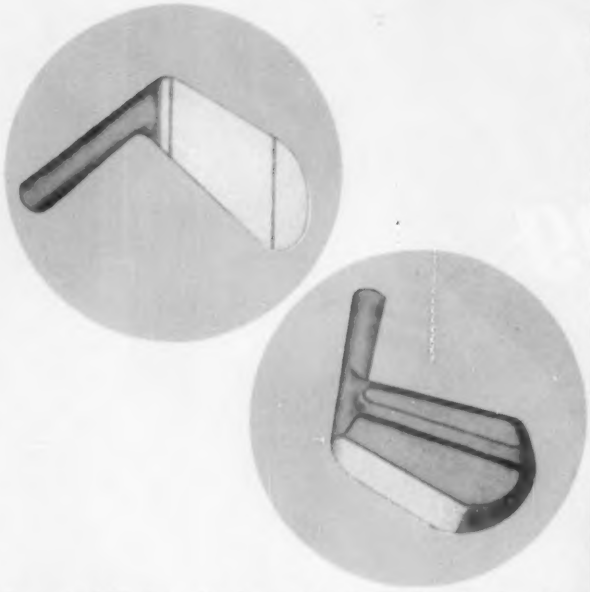
60" STROKE HORIZONTAL, ELECTRIC



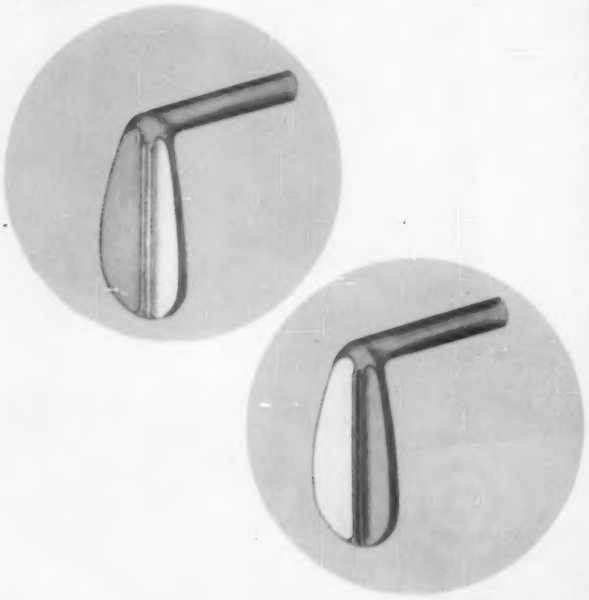
CH CONTINUOUS BROACHING, ELECTRIC



SRHE SINGLE RAM HORIZONTAL, ELECTRIC

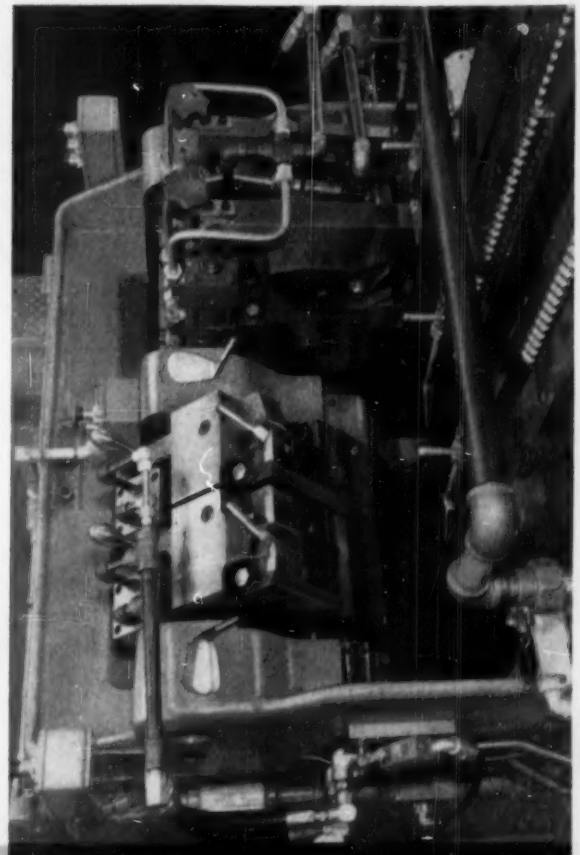


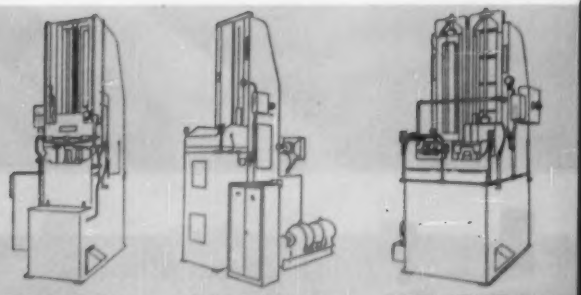
From steel forgings: the face and sole are broached on the first ram, utilizing stations #1 and #2; stations #3 and #4 at the second ram being used for the two non-parallel cuts on the back.



Broaching four surfaces on each head, at the rate of 90 complete parts per hour — *one every 40 seconds* (at 80% efficiency) — this LAPOINTE 10-ton, 66-inch stroke Double Ram Vertical Broaching Machine is setting new production records on golf club heads. Lapointe-Broaching produces a finish of such quality, that it requires minimum time for polishing. Machine is equipped with the Lapointe-patented Tip-Down Table, and hydraulic clamping.

Looking down on the Lapointe-built fixture, designed for those hard-to-hold parts. Interchangeable adaptors and clamp toes permit broaching all heads — No. 2 through No. 9 — with interchangeable broach assemblies, for differences in contour.





VUE-7 VERTICAL PULL-UP ELECTRIC

SRVE SINGLE RAM VERTICAL, ELECTRIC

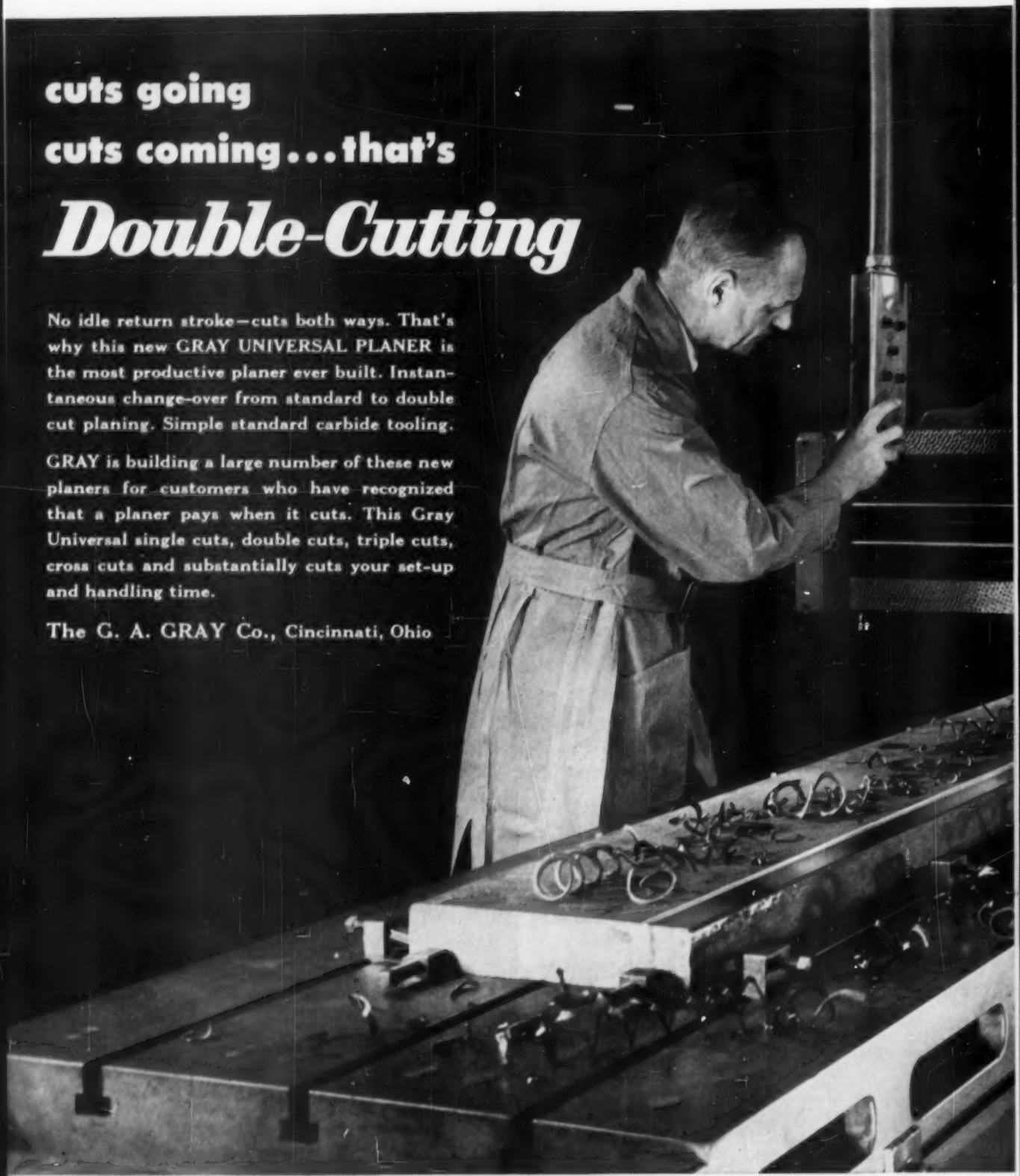
DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

BROACHING

cuts going
cuts coming...that's
Double-Cutting



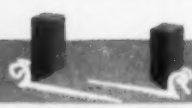
No idle return stroke—cuts both ways. That's why this new GRAY UNIVERSAL PLANER is the most productive planer ever built. Instantaneous change-over from standard to double cut planing. Simple standard carbide tooling.

GRAY is building a large number of these new planers for customers who have recognized that a planer pays when it cuts. This Gray Universal single cuts, double cuts, triple cuts, cross cuts and substantially cuts your set-up and handling time.

The G. A. GRAY Co., Cincinnati, Ohio

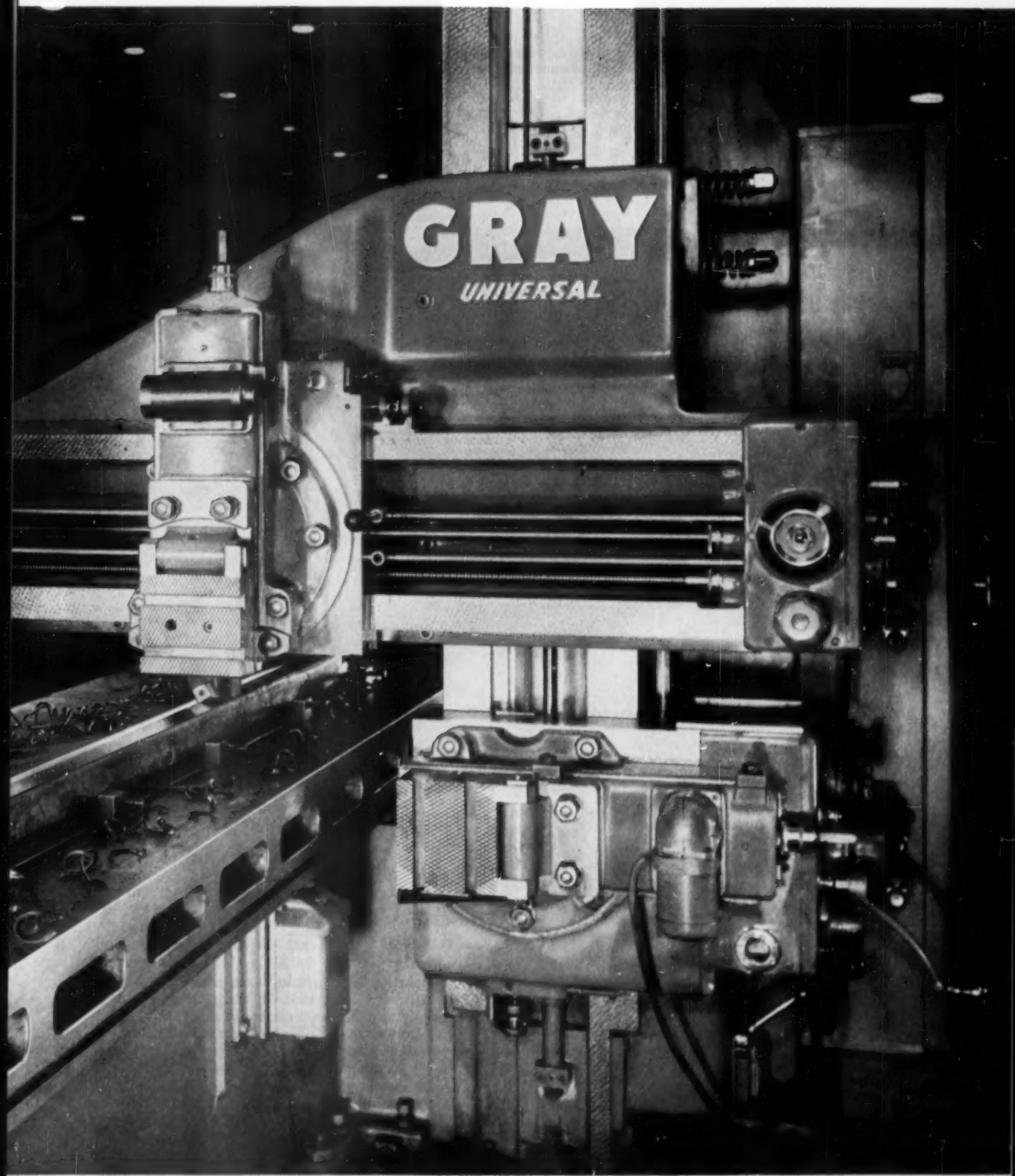
heavy-duty planing

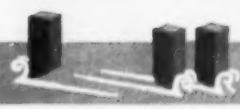
The Gray Universal is the world's most powerful planer available for conventional planing. Its rigidity and speed are ideally suited for modern carbide cutting.



double cut planing

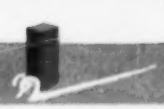
The flick of a lever, the touch of a button permits double cutting. Elimination of the idle stroke insures the world's most efficient flat surface machining. Only simple carbide tools are required.





triple cut planing

Rough and rough-finish plane at the same time. Rough by double cut planing and simultaneously rough-finish with a single point tool. Then finish plane without a tool change.



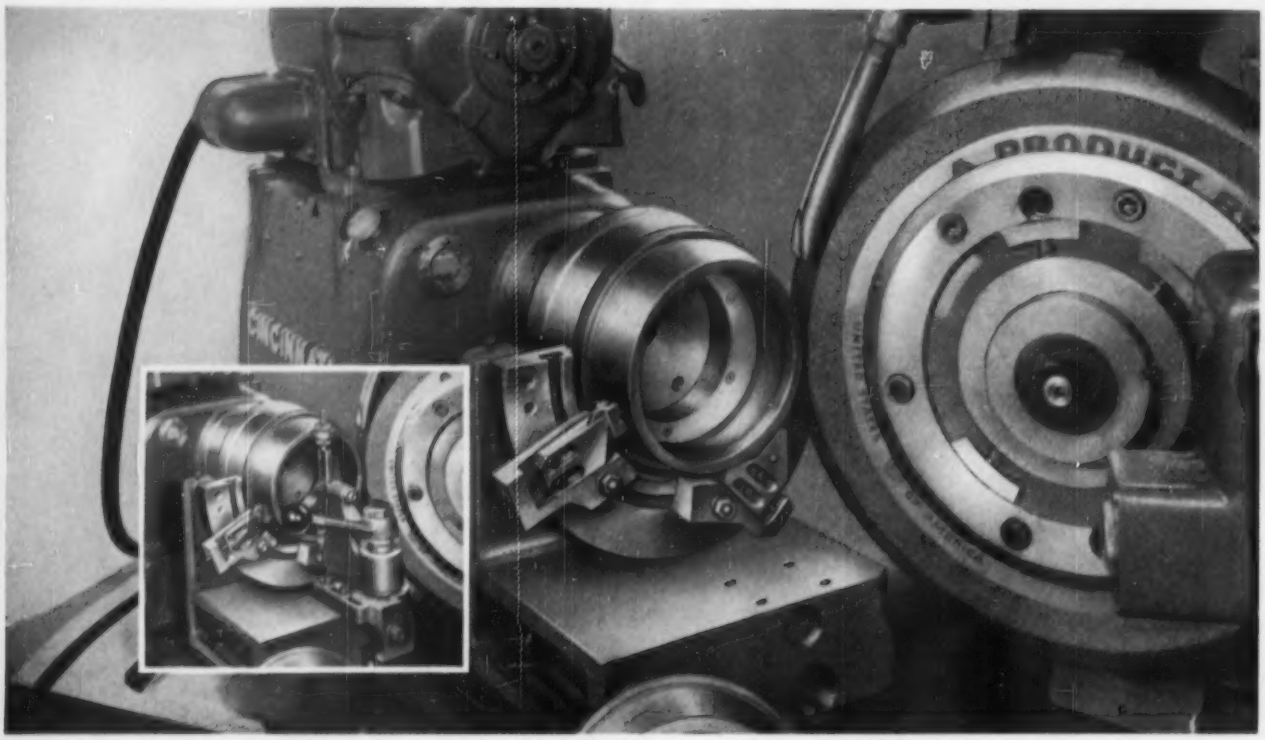
cross planing

Eliminates extra settings by cross planing the occasional keyways, chamfered corners, and other troublesome small cross surfaces that formerly added hours to your set-up time.

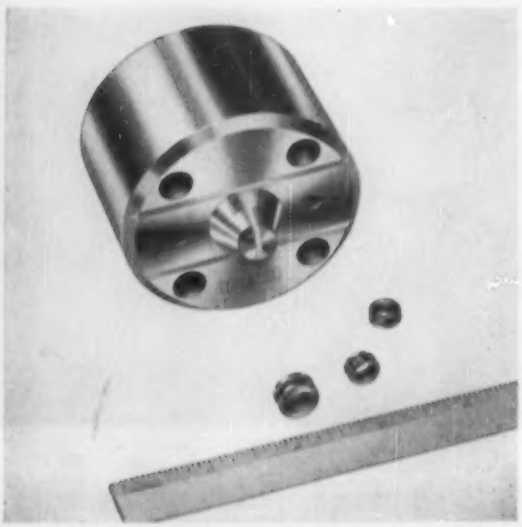
The Gray Universal is the world's most powerful planer available for conventional planing. Its rigidity and speed are ideally suited for modern carbide cutting.

The flick of a lever, the touch of a button permits double cutting. Elimination of the idle stroke insures the world's most efficient flat surface machining. Only simple carbide tools are required.

New Tricks for Machining with



Taft-Peirce Magnetic Work Drivers



Two-pole Taft-Peirce Permanent Magnet Work Driver. Magnetically holds ball bearing inner races during grinding of external ball grooves. Parts are shown in front of work driver.

This Latest Application of Magnetic Forces by Taft-Peirce provides a Real Tooling Setup at great savings!

Here's a complete tooling setup for minimum cost! Magnetic Work Drivers eliminate awkward tailstock arrangement, cost substantially less than complicated holding devices. Little or no maintenance is required, there's nothing to go wrong. Developed primarily for shoe type centerless grinding of ball bearing, inner and outer races, the T-P Work Driver can hold a variety of sizes and shapes, including tapered OD for governing valve plugs and OD and ID of valve ports. Work Drivers can be designed to handle work from ½" ID and larger. Furnished in either permanent magnet or in electromagnetic models, Work Drivers are specially designed and built for each application.

The Taft-Peirce Family

AIR GAGES • LAPPING MACHINES • PRECISION GAGES
TOOL-ROOM SPECIALTIES • MAGNETIC CHUCKS • GRINDING MACHINES

Rough and rough-finish plane at the same time. Rough by double cut planing and simultaneously rough-finish with a single point tool. Then finish plane without a tool change.

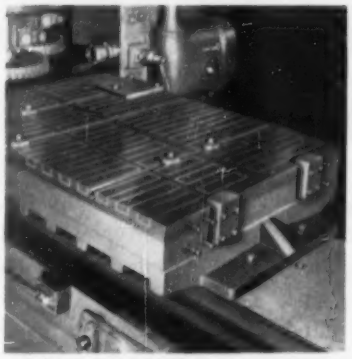
Eliminates extra settings by cross planing the occasional keyways, chamfered corners, and other troublesome small cross surfaces that formerly added hours to your set-up time.

Magnetic Work Drivers and Chucks

Superpower Rotary Electromagnetic Chucks

Taft-Peirce packs maximum holding power in a small space so that simplified, low-cost setups can be used on rotating spindles. This small Rotary Chuck is grinding close to a shoulder, without complicated fixtures. There are ten standard sizes with diameters from 5⅛" to 30½", to give the most effective holding power for the work being done. Special faceplates can also be designed.

Superpower Specials Do Wide Variety of Work

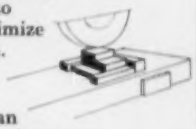


The speed and simplicity of magnetic chuck-held machining is providing lower-cost production on an ever greater range of work. The special 55½" x 40" Superpower Chuck at right was built to hold cast iron loom-sides on a 75 hp milling machine. Three 18" carbide cutters and two 4" mills take ¼" cuts simultaneously at 30" per minute. Taft-Peirce Chucks have been built to handle light planing and milling and special shapes, including holding propeller blades for shaping and contour grinding. If there is any possibility magnetic chucks can help your production, give the problem to Taft-Peirce for further study.

Tips

and IDEAS on MAGNETIC CHUCKING

Permanent Magnetic Chucks should always be faced with the pack (handle) moved to the "off" position. This assures minimum deflection of the faceplate. Electromagnetic Chucks should be turned "on" and allowed to "warm-up" to minimize faceplate distortion.



Magnetic chucks can be used to hold non-ferrous materials by "backing-up" or surrounding the workpiece with bars or pieces of steel.

Irregular shaped parts can be easily ground using the "mold" technique. Invert part, surround with a mold of lead, babbit or sulphur incorporating steel slugs near the top of the mold. Then, turn right side up, place on chuck and grind.

Get the Taft-Peirce Catalog on Chucks

Catalog No. 412 presents technical data, design details, suggestions and prices on the complete Taft-Peirce line. Find out what magnetic chucking can do for *your* production by writing: The Taft-Peirce Manufacturing Co., Woonsocket, Rhode Island.

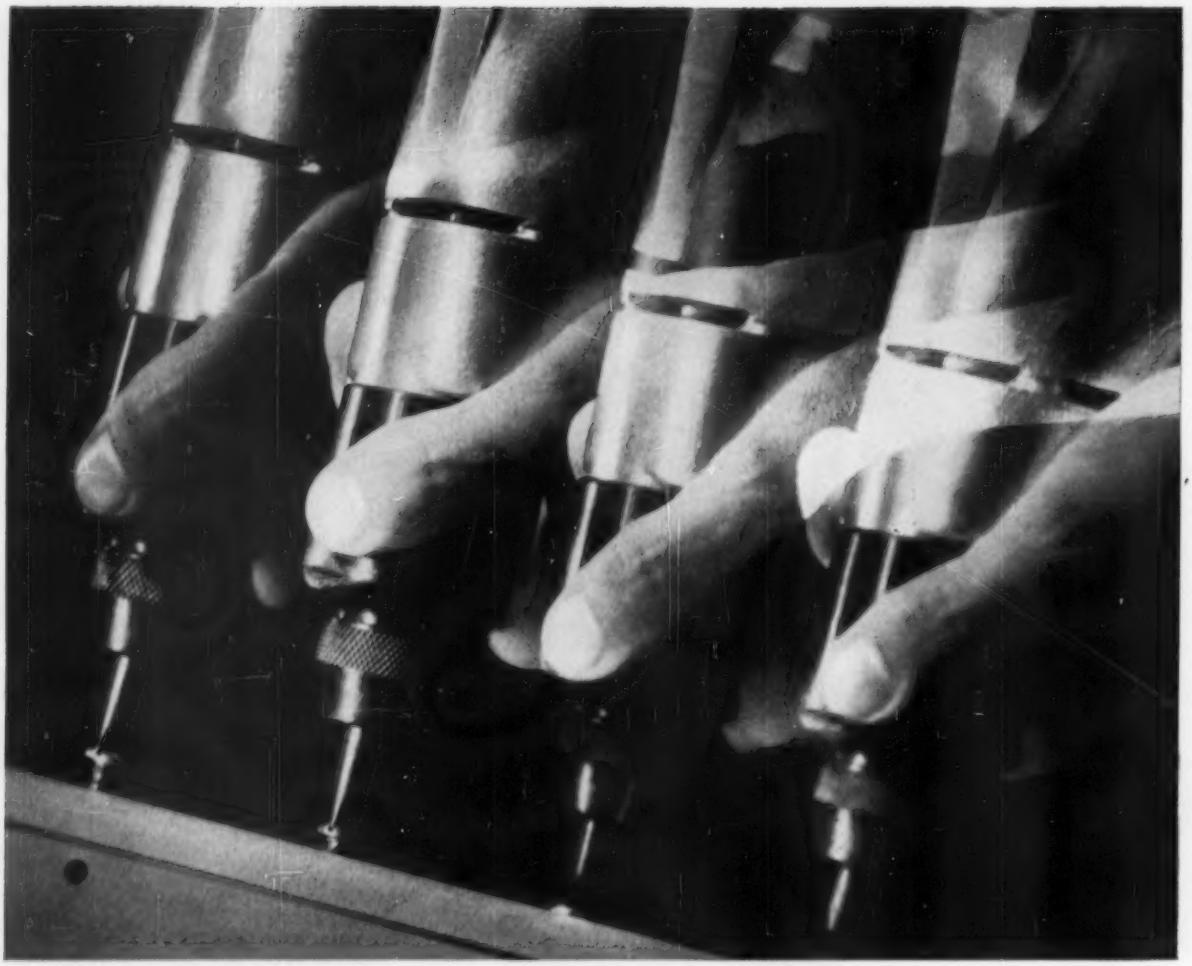
T-P

TAKE IT TO TAFT-PEIRCE

THE TAFT-PEIRCE MANUFACTURING CO.
WOONSOCKET, R. I.

T-P Means TOP Precision

that came true.



Is assembly one of your largest production costs?

It probably is. Wherever fastenings must be made, this simple truth applies: The cost of the fastener is but a tiny fraction of the cost of using that fastener in production. The key to reduced assembly costs is the fastener that helps high-paid assembly hands turn out better work—*faster*. The P-K® Self-tapping Screw is that fastener!

Using screws that don't come up to P-K standards can raise total assembly costs as much as 25%. Screw failures not only result in assembly slow-downs . . . but in parts spoilage and hidden weaknesses as well. This is especially true in assembly by automation. Uniformity, such as P-K Self-tapping Screws offer, is automation's prime requirement for trouble-free assembly.

Why not talk to a Parker-Kalon Assembly Engineer —a man who is in daily contact with many different assembly set-ups. Perhaps he can show you how to reduce the number of fastenings in your product or how to solve a particularly difficult fastening problem. (That's his business.) Contact him through your local Parker-Kalon distributor.

PARKER-KALON DIVISION, General American Transportation Corporation
Manufacturers of Self-tapping Screws, Socket Screws, Screwnails, Masonry Nails, Wing Nuts and Thumb Screws

PARKER-KALON® fasteners

Sold Everywhere Through Leading Industrial Distributors
Factory: Clifton, New Jersey—Warehouses: Chicago, Illinois—Los Angeles, California

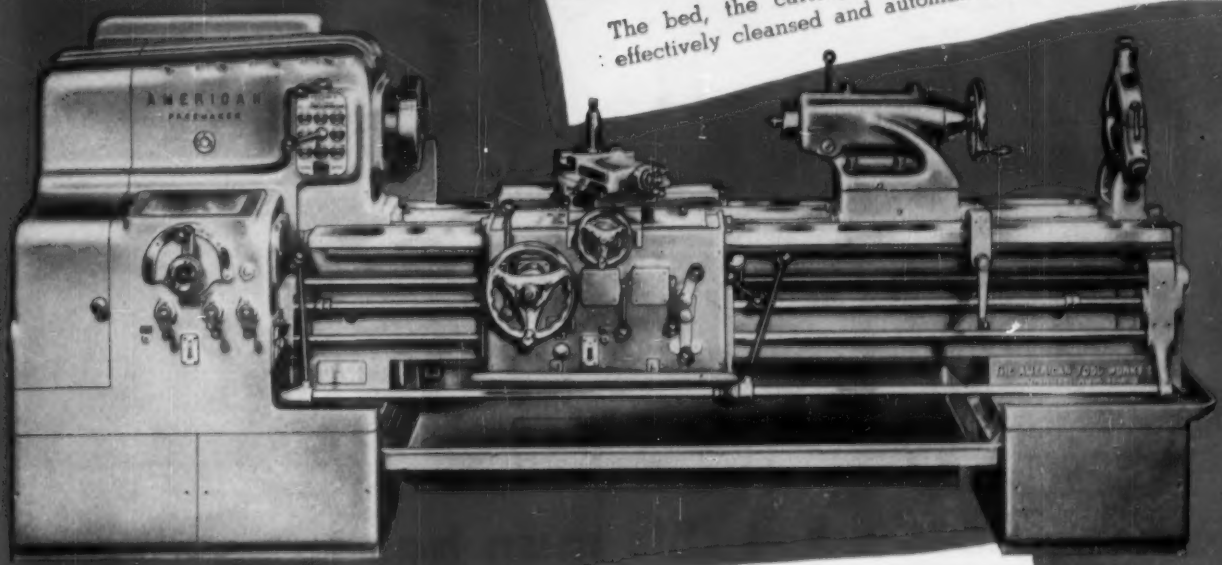
A dream that came true.

SAFETY ...a REALITY!

Safety of operation is a reality offered by the new DeLuxe "AMERICAN" Pacemaker Lathe: safety not only for the operator but for the lathe and work as well.

All operating units are enclosed and automatically oiled.

The bed, the carriage and the cross slides are effectively cleansed and automatically oiled.



The power longitudinal and cross feeds are separately controlled to avoid confusion and protected against overload and accident by self-adjusting safety clutches.

The power length and cross rapid traverses are separately controlled and protected by spring actuated multiple disc safety clutches. When power length rapid traverse is engaged the longitudinal feed handwheel is de-clutched to protect the operator and is automatically re-engaged when traverse is released.

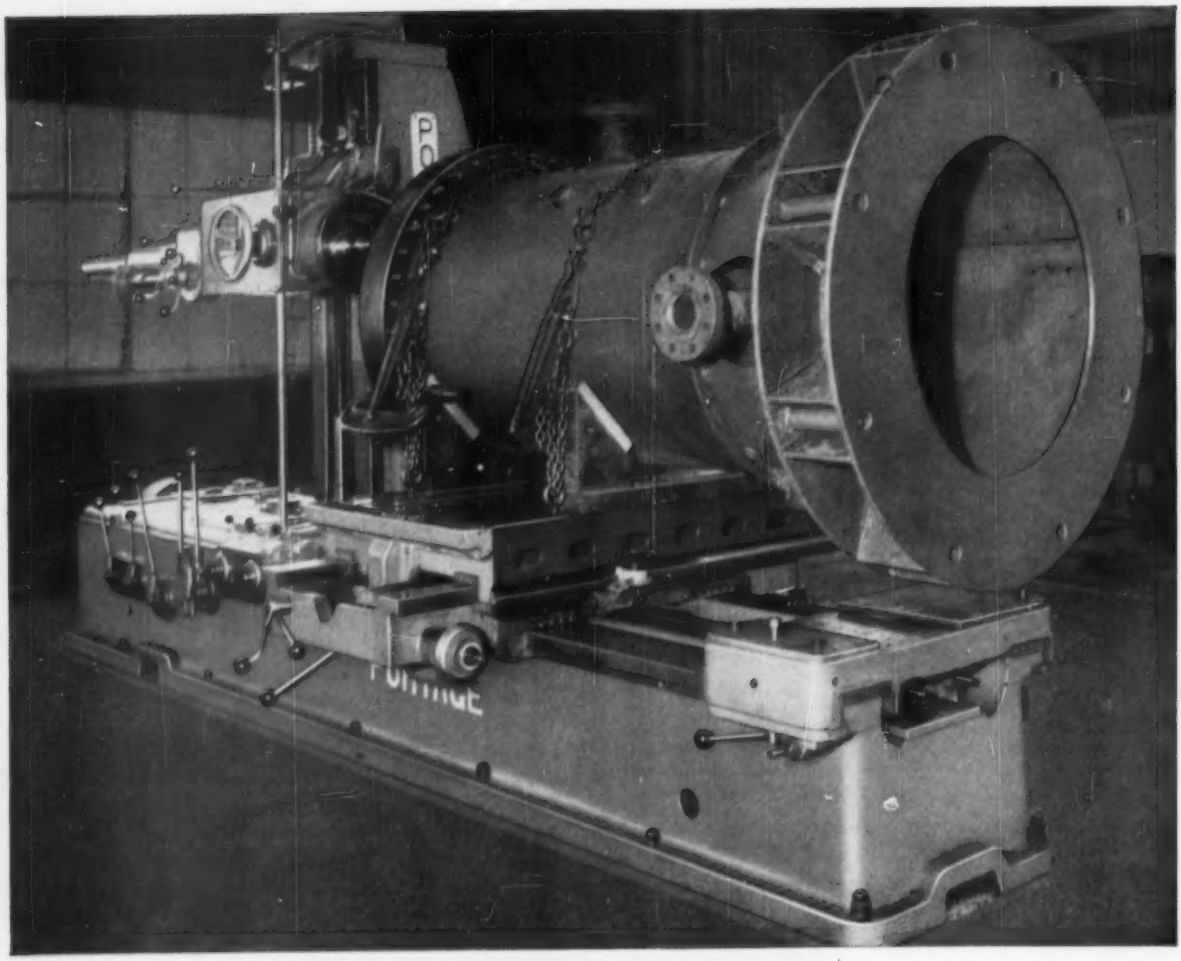
Power Feeds and Power Rapid Traverses are interlocked and cannot be engaged simultaneously.

Spindle coasting endangering operator by rotating chuck or work while miking or measuring is prevented by patented safety starting clutch and brake which also protects machine against excessive overloads.

These valuable and exclusive features are illustrated and described by bulletin No. 116—yours for the asking.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS



Photograph courtesy of Western Supply Company, Tulsa, Oklahoma

Read what this man has to say about PORTAGE MILLS!

Mr. D. W. Brady, Plant Manager of Western Supply Company, Tulsa, Oklahoma says,

"Our manufacturing facilities here at Western are devoted almost entirely to heat exchanger production. We have found the versatility of the Portage Mills allows us to do a wide variety of machining operations required in the fabrication of this type of work. We have found the machine to be very reliable and have experienced no lost time for repairs since it was installed."

Mr. Brady's kind remarks are typical of those coming in from across the country . . . PORTAGE MILLS are truly the *machine of the year* . . . and remember . . . Portage costs less to buy. Write for the illustrated catalog . . . and ask for a proposal too!

THE Portage MACHINE CO.

1026 Sweitzer Avenue • Akron 11, Ohio

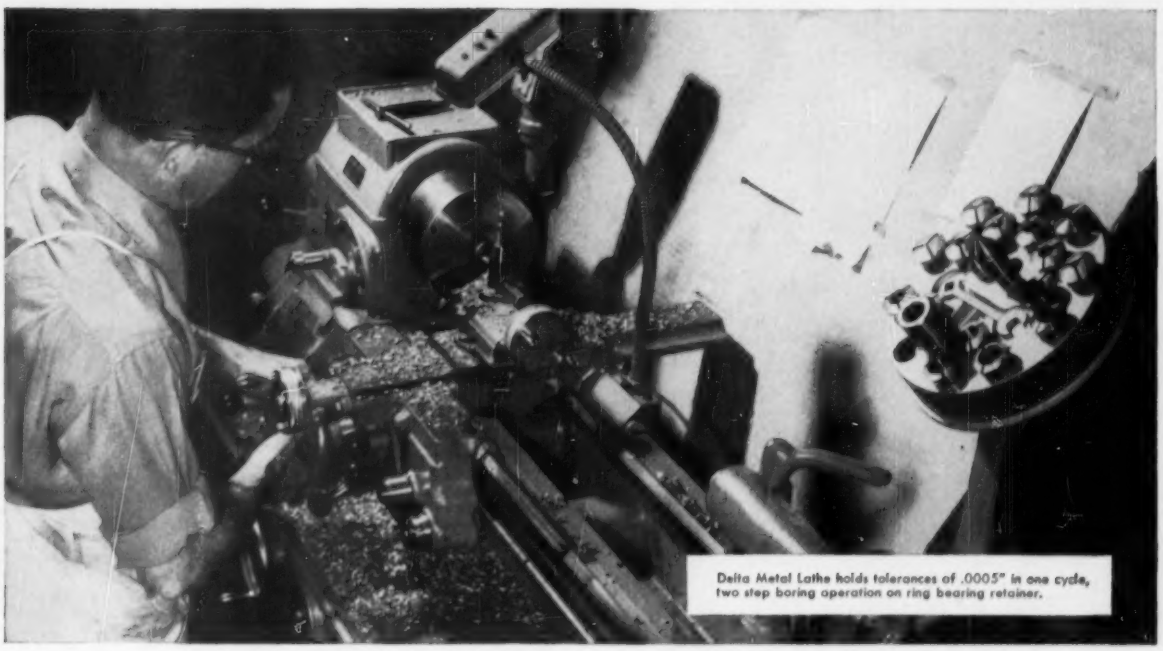
Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

ROCKWELL-BUILT

DELTA 11" metal lathe

makes heavier cuts faster than other more costly lathes tried by Carros & Hart Co., Bristol, Conn.



Delta Metal Lathe holds tolerances of .0005" in one cycle, two step boring operation on ring bearing retainer.

Donald S. Hart, Sales Manager, says:

"QUALITY CONTROL IMPORTANT—Turning out precision gears and specially designed tools and dies demands, in many cases, that tolerances of .0005" be held. Our Delta lathe meets these demands, gives us the exacting work we need.

"BEST LATHE OF ITS TYPE—In all kinds of metal, including steel, it makes heavier cuts faster than other more costly lathes we've used.

"SOUND INVESTMENT—This Delta lathe is a tremendous value for the money."

See the entire Delta 11" Metal Lathe line: 4 and 5-foot bed models—threaded spindle and tapered key drive spindle nose models—single or 3-phase motors and controls.

***NEW DELTA PRODUCTION ACCESSORIES**—Now, convert your engine lathe to an efficient production machine quickly, easily, at lowest cost!*

Compare Delta with any lathe of comparable size—or price—and make up your *own* mind! Your Delta Dealer is listed under "TOOLS" in the yellow pages.

Send for All The Facts . . . Today!

Delta Power Tool Division, Rockwell Manufacturing Co.
618-MB N. Lexington Ave., Pittsburgh 8, Pa.

☐ Please send Delta Industrial Catalog on entire Delta 11" Metal Lathe line.

☐ Please send name of my nearest Delta Dealer.

Name _____ Title _____

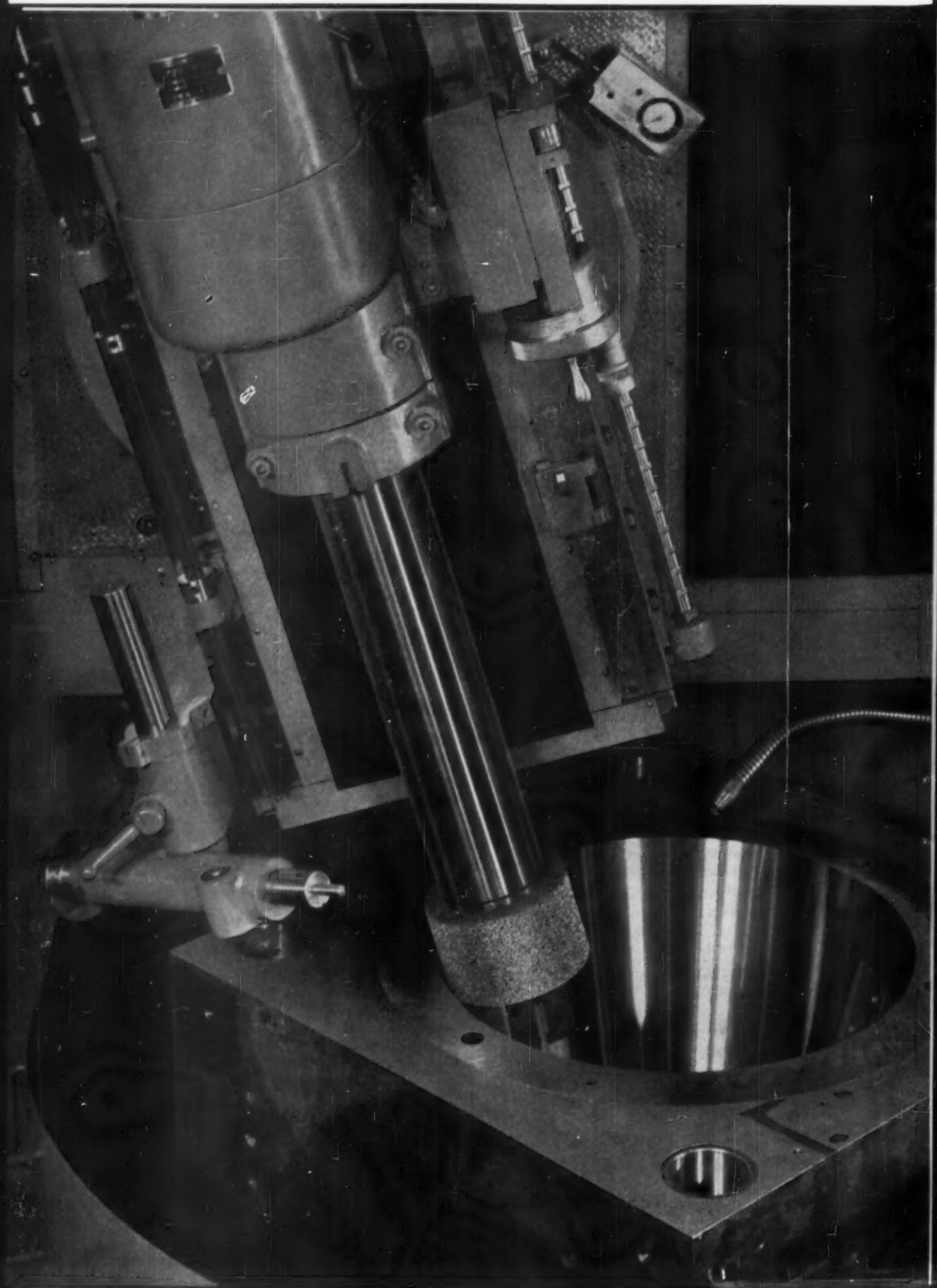
Company _____

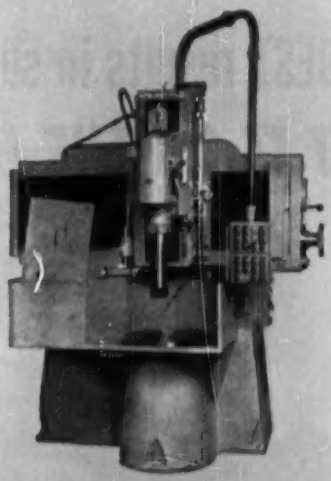
Address _____

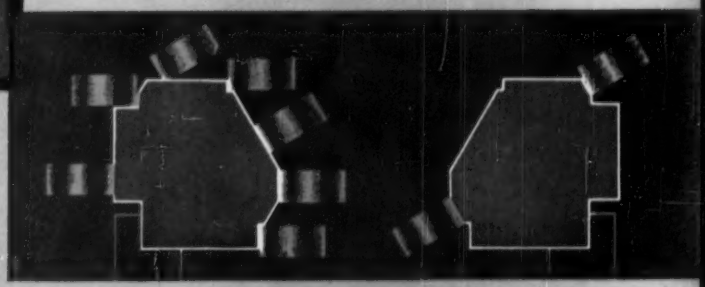
City _____ County _____ State _____

DELTA ROCKWELL

another product by **ROCKWELL**







one setup: nine jobs

As flexible, as responsive as a dentist's drill, a Springfield Vertical Universal Grinder can reach around and into a workpiece to do nine different jobs on one chucking.

If you make a pipeline valve, a mold, a bearing race—requiring micro-inch finish on any or all the faces shown in the diagram—at whatever angle—look into Springfield. These grinders cut down the number of set-ups, frequently eliminate hand-lapping, operate with fewer work-holding devices. And, as a bonus, on jobs calling for extreme concentricity, one angle setting of the Springfield head grinds both faces of mating parts.

All three models readily adaptable to special problems.

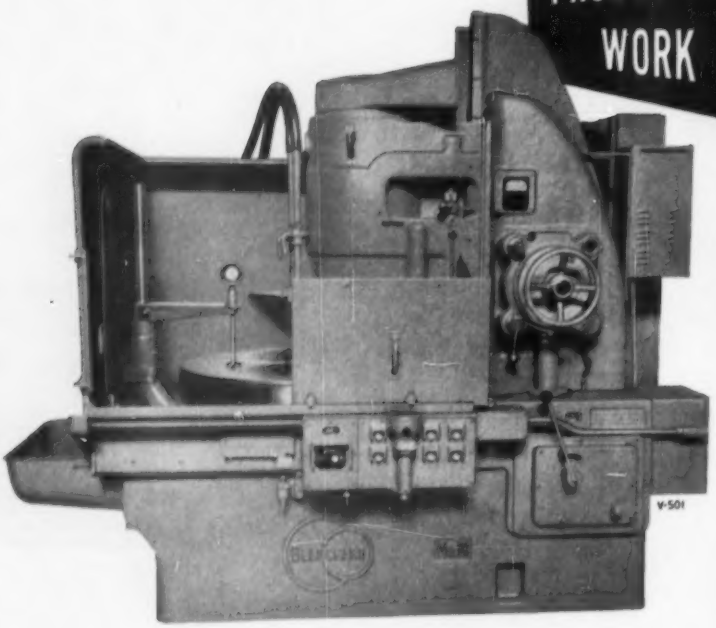
Vertical Universal Grinders: swings 18", 24" and 42".

Lathes: Engine and tool room, contouring and reproducing—swings 14" to 32".

The Springfield Machine Tool Company
Springfield, Ohio
125TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS

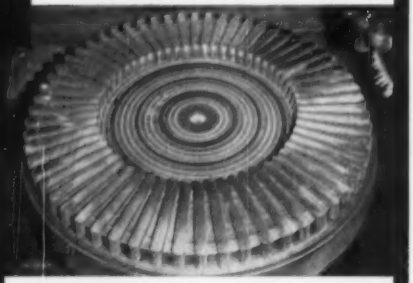
SPRINGFIELD

for BEST results in surface grinding...
PUT IT ON THE BLANCHARD



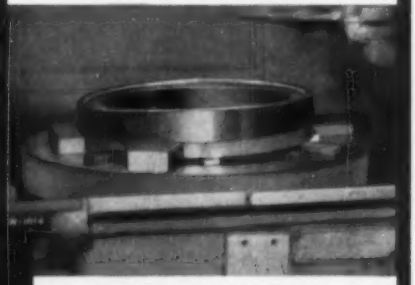
PRODUCTION WORK

SIDE PLATES. 9" x 18" plates ground from rough on No. 18 Blanchard with 36" chuck. Stock removal 1/16" to 1/8" per side. Held flat within .003", parallel to .001", and to dimension tolerance of ± .001". Production: 30 surfaces per hour.

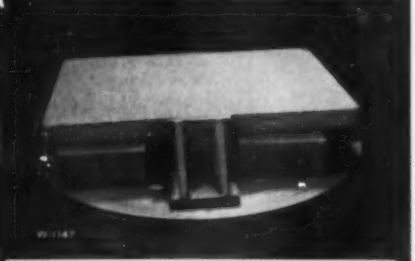


CONNECTING LEVERS. Cast iron levers ground in special magnetic fixture with pins located in "vee's". Stock removal per side is 1/32" to 1/16"; must be flat and at right angles to pins. No. 18 production: 180 pieces per hour, compared to 20 pieces per hour by former method used.

MAINTENANCE AND ODD LOT WORK



HARDENED STEEL PUNCHES. This 24-13/16" dia. punch, reground on a No. 18, is centered radially on 36" magnetic chuck. Duplicate circumferential and radial shear reliefs are generated with two setups.



GRANITE SURFACE PLATES. A No. 18 Blanchard reconditions this 18" x 34" granite surface plate by grinding it flat within .0002". 3/16" of stock is removed in 5 hours.

Blanchard Grinders are used throughout industry on surface grinding jobs that demand the utmost in production, finish and accuracy.

Whatever *you're* surface grinding, there's a Blanchard designed to do the job speedily and accurately.

PUT IT ON THE BLANCHARD

Send for free copies of "Work done on the Blanchard", fifth edition, and "The Art of Blanchard Surface Grinding".

THE BLANCHARD MACHINE COMPANY
64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

SPRINGFIELD
Springfield, Ohio
65TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS

You Can "Gage" Us By What's In PMCo Boxes

When you open a shipment of PMCo Gages, you may not notice it but we have packed more than gages. Our reputation is packaged with PMCo Gages. It's been this way for years.

Our reputation has been founded and fostered by a group of thoughtful craftsmen bound by one ideal —making the finest and most accurate gages possible.

We don't want to be the biggest— just the very best.

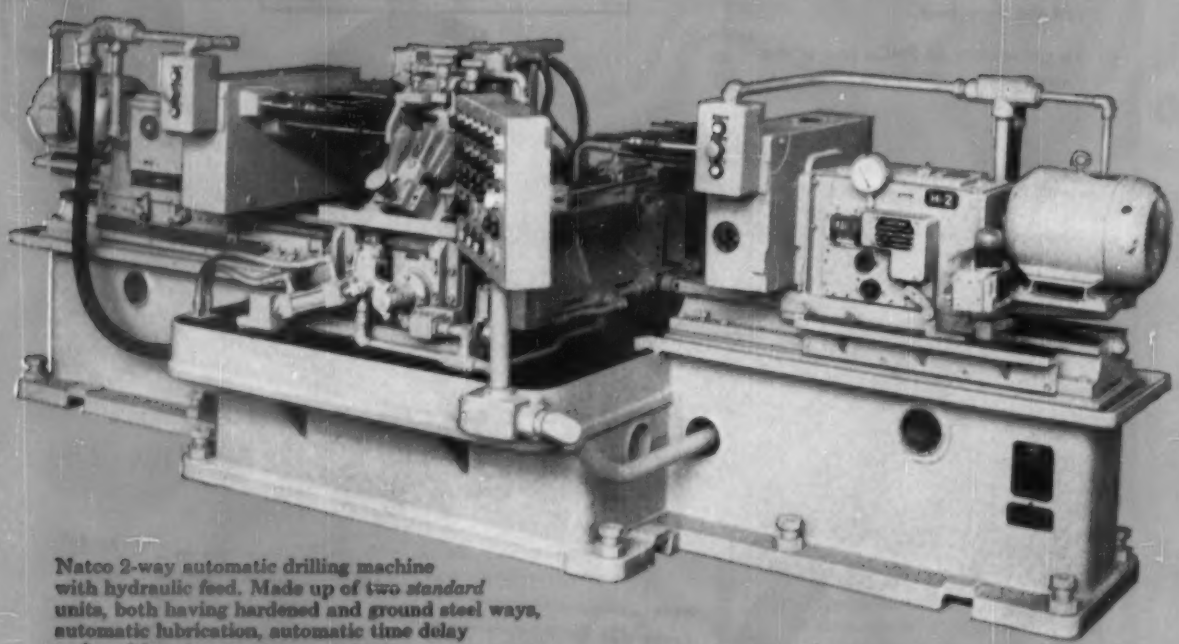
To get a copy of PMCo line of the finest gages, write us for Catalog No. 10.

THE PIPE MACHINERY COMPANY
29100 Lakeland Blvd. • Wickliffe, Ohio
Greater Cleveland

AM-#10

Name _____ Title _____
Company _____
Address _____ Zone _____ State _____
City _____

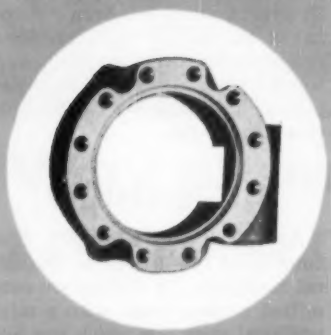
Natco Standard Units Perform Special Jobs

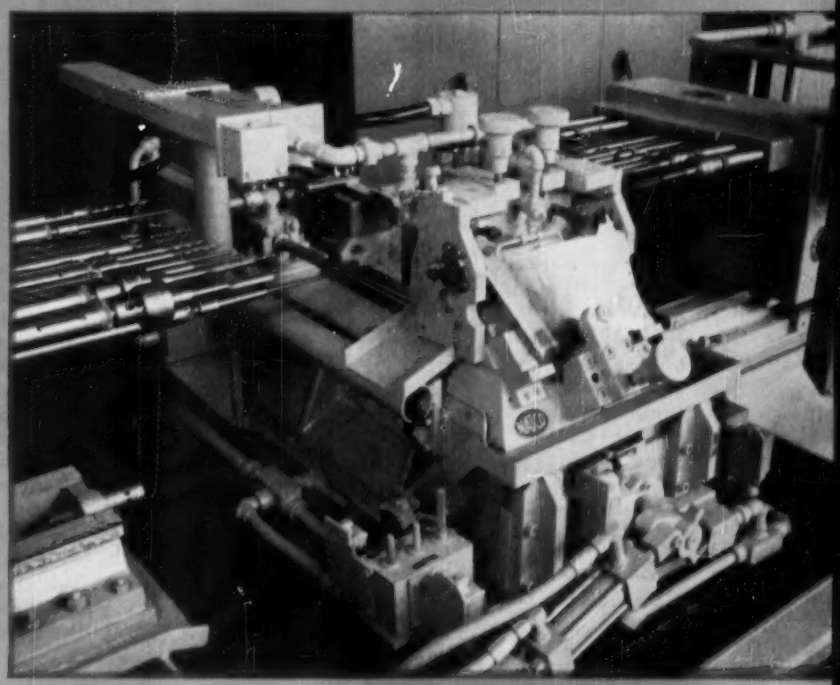


Natco 2-way automatic drilling machine with hydraulic feed. Made up of two *standard* units, both having hardened and ground steel ways, automatic lubrication, automatic time delay and positive stop.

Many *special* jobs can become routine with Natco's *standard* unit design. Take these parts, for instance. Unique parts presenting unique problems. Natco solved them by using *standard* horizontal, self-contained Holeunits with automatic fixtures. Varied operations are performed—production to meet customer's requirements.

Natco's use of *standard* units can mean quicker delivery and lower price to you. Call a Natco Field Engineer to determine whether Natco's *standard* unit design can solve your "special" problems.





Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan.

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC.

Richmond, Indiana

Multiple-spindle drilling, boring, facing and tapping machines. Special machines for automatic production.

Call Natco offices in Chicago, Detroit, Buffalo, New York, Boston, Philadelphia, Cleveland and Los Angeles; distributors in other cities.

Special Size Reamers
ARE STANDARD WITH L&I

TWO MORE L&I EXCLUSIVES ...AT NO EXTRA COST!

DOWEL PIN REAMERS
Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.
14 Sizes from .1230 thru .4995" Sets, tool

OVER & UNDER SIZE CHUCKING REAMERS
Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.
14 Sizes from .124 thru .501" Sets, tool

These reamers are two more reasons why L&I is the source for a **complete** reamer line.
See your L&I Distributor.

L&I

"the reamer specialists"
LAVALLEE & IDE, INC.
CHICOPEE, MASS.

Letters...

To American Machinist
330 W 42nd St, N Y 36, N Y

Tocco Process Patent

In the article, "Burnishing and Hardening Built Into Automatic" (AM— Sep 24 '56, p124), the credit line was omitted from the drawing on page 127. The drawing was provided by Tocco Div, The Ohio Crankshaft Co, which holds a process patent on the process of heat treating on a machine tool.— Ed.

Here's Why

...One complaint I have—the article on shop machinability testing (*AM*—Aug 13 '56, p128). Maybe you should have had Mr Zoellner (project engineer, statistical section, GE Cincinnati) write it instead of Mr Halverstadt, because where are the statistics discussed that the headline promises? And I don't think you should print any article that discusses tool angles so much without a sketch showing just what angles are being used, as in this case. A few data points would do no harm, either.

E G Loewen, staff engineer,
The Taft-Peirce Mfg. Co.
Woonsocket, RI

We explained to Dr Loewen that any headline error was ours, not the author's, and that a broad paper on a subject such as this is highly necessary. We also pointed out that the subject was statistics, not the effect of tool angles. We communicated with Mr Halverstadt and print his reply below. Dr Erich Loewen has been a member of the staff of MIT, has done much machinability research, and has been co-author of many papers on the subject with Dr Milton Shaw.—Ed.

Data Incomplete?

As you know, when we first considered the article on statistical machinability testing, we submitted a manuscript with a mild technical approach which you felt would not be of general interest. Therefore, our article dealt almost

SHOPMATES

N. Jarvis

DON'T TELL ME "LULLABY LARRY" IS OFF AGAIN!! I WOKE HIM UP NOT TEN MINUTES AGO···
···AND HE'S THE GUY WHO HAS INSOMNIA??
HE CAN'T HELP IT··· COUNTIN' THE TURNS AND HOLES ON A DIVIDIN' HEAD IS LIKE COUNTIN' SHEEP··· IT'D PUT MORPHEUS TO SLEEP !!
Z Z Z z
N. JARVIS

Why should you use valuable floor space to make parts like these?

FERRULES
for desk and chair legs, pipes, tool handles, cutlery handles and pencils, etc.

EYELETS
for all types of industrial fastening applications

GROMMETS AND WASHERS
standard sizes in stock for canvas and fabric hardware and other uses

STAMPED PARTS
of every description, including washers of heavy or light metal

SCREW SHELLS
for lamps, tubes, all electrical applications

DEEP DRAWN PARTS
cups and shells of all types, finished or unfinished

The American Brass Company has specialized equipment, such as high-speed multiple-plunger presses, for the economical production of parts like these for industry. It has thousands of stock tools which may save costly tool charges—tools and techniques developed over a century of service to manufacturers.

Your choice of metal: Parts like these can be furnished in copper, brass, bronze, nickel silver, nickel, iron, stainless steel, steel, and aluminum—in a wide variety of finishes.

Standard products: For a selection of more than 1000 eyelets of common sizes and styles, as well as eyelets kept in stock, write for Catalog BG-1.

Special products: Just send a sample, drawing, or description, together with quantity and other pertinent information. Address: The American Brass Company, Fabricated Metal Goods Division, Waterbury 20, Conn. 5003 (Rev.)

ANACONDA® MULTIPLE-PLUNGER PRESS PRODUCTS

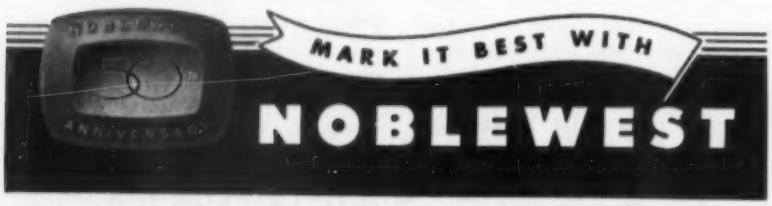
Automation
IN MARKING

MARKS
7500 PIECES
PER HOUR

Capable of speed-marking 7500 parts per hour, this hopper and dial feed machine is just about the nearest thing to automation in marking. As illustrated above, Model 435 features a vibratory parts feeder, 30" bowl and a dual track carrier. Parts are fed to the machine from the bowl, then permanently marked and automatically ejected. Spring pressure controls depth of mark and insures clear uniform imprint. Ideal for speed-marking solid, round, heavy walled or conical parts. Like all Noblewest Roll Marking equipment, it produces permanent indented impressions . . . good for the life of your product . . . *at faster speed and lower cost.* For detailed information write Noble & Westbrook Mfg. Co., 17 Westbrook St., East Hartford 8, Connecticut.

Noblewest is equally famed for its fine marking dies.

NEW CATALOG—Write for copy of our comprehensive catalog containing the complete NOBLEWEST line, and illustrations of hundreds of modern metal marking applications.



MARKING MACHINES • MARKING TOOLS

completely with results, rather than the testing approach.

I would be happy to discuss the data and as many data points as Dr Loewen would be interested in observing, but I do not believe that it would have had a place in this article, since we are trying to appeal to a wide group of readers.

As for the tool angles, I believe they are fairly well defined in the article since, in your caption below Fig 2, 3, and 4, you clearly state that this is a side relief angle and did not say it was the normal side relief angle. This particular angle is completely defined by the ASA publications which, of course, are the ones we use here in the laboratory.

It may be of interest to know that we endeavor to separate the effect of each variable and, therefore, it is not always necessary to consider the rest of the tool geometries when any one angle is being studied. We do recognize that the rest of the tool geometries will definitely affect the results, but the statistical method is usually able to separate the two.

R D Halverstadt
Metal Working Laboratory
General Electric Co
Cincinnati

Many Thanks

Thank you very much for the 100 copies of your editorial, "Let's Start With the Schools" (*AM*—Sept 24 '56, p115). I plan on distributing these to many people in Illinois. I have already given a copy to each supervisor in this office, have kept some copies for myself, and have given the rest to Mr E M Claude, my chief.

It is my purpose to give the copies that I have to superintendents of schools, high-school principals, and local directors of vocational education. Mr Claude plans on using his copies next Spring at a national meeting to be held in the northern part of the state.

Robert B Newell, *supervisor*
Trade & Industrial Education
Board of Vocational Education
Springfield, Ill.

It Can Be Done

In your recent Talking Shop columns (*AM*—Nov 19 '56, p169) you stated that both Hiram Walker and Minnesota Mining &

Mfg Co. were unable to find a machine that would tie Christmas gift-wrapping bows for Hiram Walker decanters.

We are negotiating at this time to buy a small plant and patents covering the manufacture of a machine that does tie these Christmas gift-wrapping bows, and which can be made to tie different numbers of loops, so that any combination of bows can be made automatically with this machine. These machines have been on a special lease and license arrangement for several years and were used to promote the sale of a particular brand of ribbon.

If one company uses as much as 8000 miles of ribbon, as you state, there is a much, much larger market for this machine than we have ever been able to determine.

J B Hutchinson, president,
M-H Equipment Co Inc
Dallas, Texas

We learned long ago never to say something never could be done, so we didn't say there was no such machine — we said that Hiram Walker couldn't find one. As for the 8000 miles of ribbon, a quick calculation indicates that this should be enough to decorate bottles to provide every man and woman of drinking age in the U S with a couple of quick ones before dinner. It seems possible, but then our source had just visited one of the plants involved. — Ed.

Paging Mr. Coswell

We have received a communication from H S Coswell, 10 Waverley Ave, Hamilton Beach. Unfortunately, he omitted to mention the State, and our reply to Hamilton Beach, Long Island, has been returned. Will he please advise us as to where to write.—Ed.

Scotch?

I was interested in Mr Mackinnon's letter (*AM*—Dec 3 '56, p90) regarding the reaction to automation in his plant in Scotland. However, I don't think he or his fellow workers have much to fear because all signs point to a definite increase in employment as the result of automation. Incidentally, I can't help wondering just what he had in mind when he wrote, "More power to your elbow."

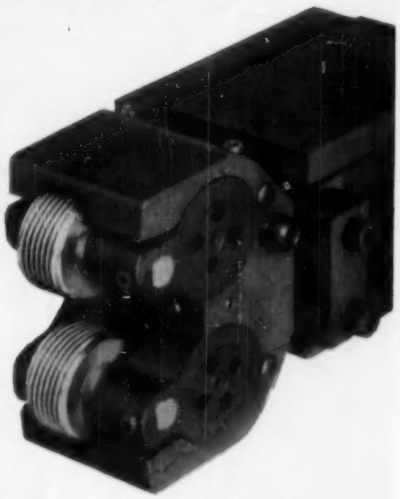
Geo Hendricks
Terre Haute, Ind.

Reduce Threading Costs
on AUTOMATIC SCREW MACHINES ... with

NEW SERIES B

REED RTD

Thread Rolling Attachments



A multi-purpose tool of wide range for rolling machine screw threads, straight and taper pipe threads (including dryseal), annular rings, oil grooves, knurling and other cold forming operations. Eliminates secondary operations by rolling behind shoulders.

- For over 100 different single and multiple screw machines
- Adapters for more than 300 cross-slide applications
- Easy to set up and operate
- Simple precision matching with prematched rolls
- Dovetail clamping arrangement simplifies setup by permitting head to be removed from adapter

SELF-COMPENSATING ROLL ACTION simplifies setup, provides longer roll life and reduces down time to a minimum. The ***side and alignment compensators*** ease undesirable side pressures on the rolls and assure smooth contact and withdrawal from the work. The ***advance compensator*** allows rolls of the same diameter to be used and permits either roll to contact the work first.

FOUR STANDARD SIZES

Model No.	Complete Diameter Range	*Pipe Threads That May Be Rolled	Approximate Number of Common Screw Threads That May Be Rolled
B 10	0 - 5/8"	7	80
B 13	1/8" - 13/16"	9	90
B 18	1/4" - 1 1/8"	15	105
B 36	3/8" - 2 1/4"	18	185

*Straight and Taper Pipe Threads, including Dryseal (NPTF). Change may be made from Straight to Taper Threading by changing rolls only. No other equipment is necessary.

ATTACHMENTS DESIGNED FOR SPECIAL APPLICATIONS

REED SERVICE PERSONNEL AVAILABLE to assist with initial installation. Application and Operating Instruction Book supplied with each attachment. Complete satisfaction assured.

Write for Attachment Bulletin B-1

REED ROLLED THREAD DIE CO. 198-A

Specialists in Thread and Form Rolling Tools and Equipment

WORCESTER 1, MASSACHUSETTS, U. S. A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

new Starrett HI-PRECISION micrometer
reads direct in ten-thousandths

Only with this new Starrett No. 221 HI-PRECISION Micrometer do you get direct readings in ten-thousandths of an inch plus automatic spindle pressure control.

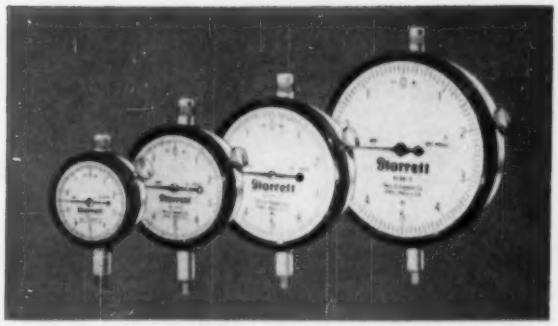
It eliminates reliance on "feel" . . . gives every craftsman the measuring skill of an experienced gagemaker. It's an ideal mike for machinists, inspectors . . . anyone who has a micrometer more or less constantly in hand.

When you want the best in precision measuring tools, you think instantly of STARRETT. It's the name that means quality, dependability, accuracy beyond question. Did you know that among the more than 3,000 Starrett products there are many other items you buy or use every day? Starrett dial indicators, steel tapes, hacksaws, hole saws, band saws, band knives and precision ground die and flat stock are all available through the same convenient source of supply . . . your INDUSTRIAL SUPPLY DISTRIBUTOR.

WHEN YOU MEAN PRECISION YOU SAY STARRETT

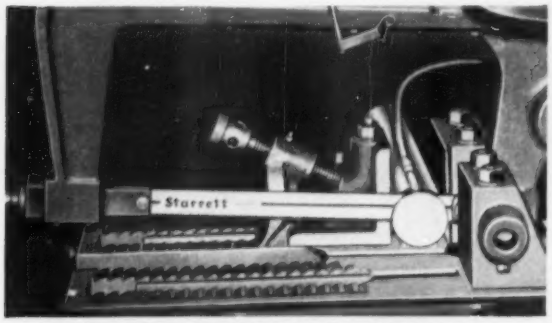
NO. 167 STAINLESS STEEL RADIUS GAGES

Made of stainless steel — rustproof and stainproof — satin no-glare finish. Each gage has five gaging surfaces for convex and concave radii. Available in six convenient sets in plastic case. Handy gage holder also available.



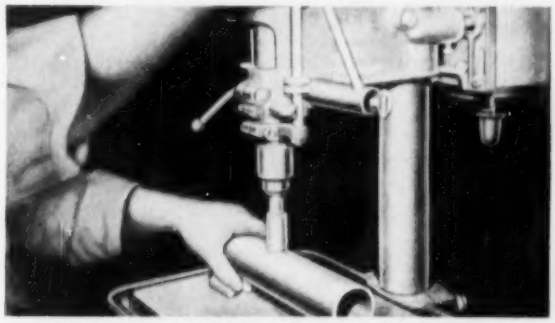
NEW HIGH-PRECISION, LOW-FRICTION INDICATORS

In standard AGD indicators Starrett offers 140 new models. All No. 25, No. 655 and No. 656 Regular and NONSHOCK Indicators have identical, *interchangeable* gear mechanisms. Any gear unit and any case assembly can be quickly combined.



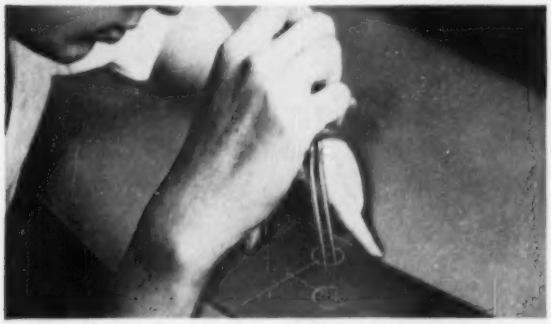
NEW PRODUCTION-PROVED HACKSAWS

Production-proved to give you better cutting performance, longer blade life . . . color identified to help you select the right blade for any job. These new Starrett faster-cutting, longer-lasting hacksaws are now available through your Industrial Distributor.



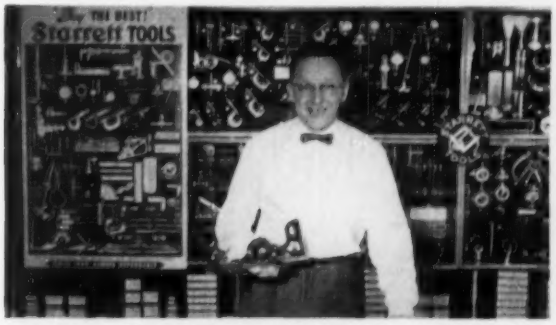
NEW SAFE-FLEX® HOLE SAWS

New double-welded, shatterproof hole saws for cutting large diameter holes in metals, plastics, wood. Interchangeable arbors hold wide range of saw sizes. Shanks fit portable power tools, lathes, drill presses, etc.



DIE AND FLAT STOCK — NOW OVER 1000 SIZES

Precision ground to Starrett standards of accuracy. Available in oil, water, oil and water or air hardening types. A great time and money saver. "Just lay it out . . . and saw it out" to save valuable man and machine hours.



AVAILABLE THROUGH YOUR INDUSTRIAL DISTRIBUTOR

You get quality beyond question from a convenient and reliable source of supply when you buy Starrett Tools through your Industrial Supply Distributor.

BIG NEW CATALOG NO. 27

New No. 27 Catalog describes and illustrates the complete Starrett line. Ask your Industrial Distributor or write for free copy. Address Dept. C, The L. S. Starrett Company, Athol, Mass.

Starrett

HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

SINCE 1880
WORLD'S GREATEST TOOLMAKERS

You get what you want with

DANLY

PRESSES

PLANT SUPERINTENDENTS

get production they can count on

Danly Presses work full time. You don't have to worry about breakdowns and there's less "waiting" time because dies last longer between grinds. Precise, accurate alignment of Danly Presses makes set-up faster, too. Manpower efficiency goes up because controls are designed for fast, safe operation.

Your Danly's stay in top shape, too. Maintenance crews can't "forget" to lubricate a Danly Press—automatic, built-in system circulates oil under pressure all the time the press is in action. You get the production you want with Danly Presses—when you want it.

DANLY MACHINE SPECIALTIES, INC.
2100 S. Laramie Ave., Chicago 50, Ill.

Ask for your copy of the Danly "Press Catalog." It gives the whole story on how Danly Presses are built for you. Write today.

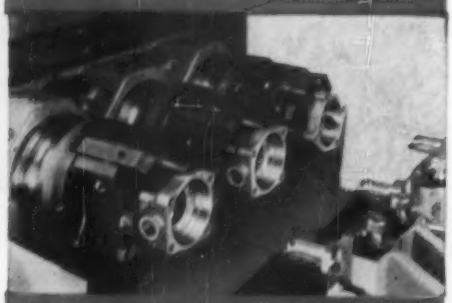
NEWS REPORT

Spot news...

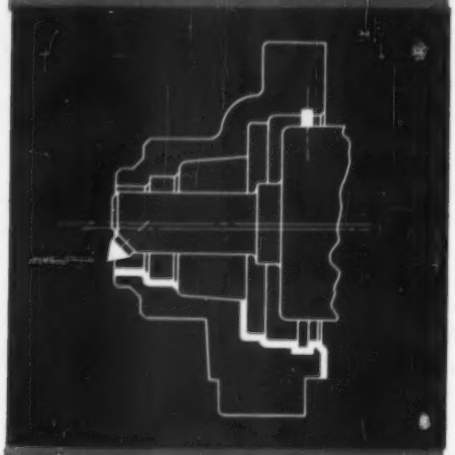
- **Double-declining balance method of depreciating production equipment** is being used by about one-third of capital goods producers surveyed by Machinery & Allied Products Institute. Another third use the sum-of-the-digits method.
- **10 million of U S production equipment will be taken into Brazil** initially, and 400-million cruzeros ($22 million) will be spent in Brazil itself by General Motors in setting up a 6-cyl Chevrolet engine plant and foundry for output of Chevrolet trucks. It is said an entire Chevrolet production line will be moved from Flint to Brazil. Sheet-metal car parts and other components will continue to be made at GM's plant near Sao Paulo.
- **Potentially super-strong magnets are being produced from iron "dust"** by GE researchers. Magnets are made by precisely controlling shape and size of iron particles so small that there are more than a billion billion in a pound. Not yet available commercially, magnets can be embedded in plastics, metal, rubber, or glass, and they are easily machined, drilled, tapped, soldered, or molded precisely into any desired shape.
- **Skilled metalworking labor pool of Hungarian refugees is piling up** at Camp Kilmer, N J, but so is confusion over how you hire them. Trouble is lack of coordination between sponsoring charity organizations and government bureaus. One thing, don't go to Camp Kilmer for them—you'll only add to the confusion. Best way is to contact your local church groups. (See p106 for details.)
- **Chevrolet will step up output of its super transmission to 12,000 a month.** This should bring the cost down somewhat from the current optional accessory price tag of $250. Reason: Chevvy must offer more competition to Ford's hard selling.
- **Unions may make a drive for job evaluation studies soon.** Case in point: Steelworkers' Union plans to ask foundries to make such studies.
- **Canada may establish an employment-immigration office in Chicago** with an eye to encouraging skilled tradesmen of all kinds to come to Canada. It's a complete switch on the recent trend of U S firms toward hiring Canadian workers.
- **First $50,000 spent by any company on equipment and plant** should be written off by any method the management chooses. That's the proposal made before a Congressional hearing by Milton Roy Co's R T Sheen. The idea: to encourage growth of small business, particularly makers of automation equipment.
- **Suez crisis has precipitated a crisis in Britain's auto industry.** Sales dropped off two-fifths in the normally good London Motor Show month. Exports to Western Europe have dropped drastically. Output has been curtailed 30% already and automakers' labor forces are being cut accordingly.
- **First U S jet-engine overhaul plant,** a $5-million facility, will be set up by Eastern Airlines at Miami's International Airport.
- **"Small business" is a varying term in various industries,** the government has ruled, establishing these arbitrary dividing lines by number of employees: internal combustion engine makers, under 1000; farm machinery makers 250; ball-bearing makers 250; power transmission equipment 1000; construction and mining machinery 500; special industry machinery 250; industrial furnaces 250.

Spot index to major News stories...

Hungary's Freedom Fighters—Boon to U S Metalworking 106
U S Needs More Technical Training 108
U S Business Looks at 1957 109
Field Report 110
Names in the News 113
Washington 51
Detroit 53
Machine Tools 55
What's Ahead
In Metalworking 59
In Business 60



Showing parts mounted in the chuck. Without chuck changes, any of three parts having different exterior forms but identical interior contours can be accommodated.



12 operations are performed in one machine cycle. Heavy lines denote surfaces machined.

Intricate contouring is fast, accurate—

12 operations in one cycle!

Direct cam action—no levers—provides Ex-Cell-O Precision Boring Machines with accuracy, versatility and speed in difficult contouring operations.

In the application shown here—contouring an internal form in die-cast aluminum end covers—limits on diameters are held as close as plus or minus .0005 inch, and three work pieces are completed at a time. 12 separate operations are performed in one machine cycle, including precision boring, facing, chamfering and grooving.

Cams can be changed in minutes. Cam assembly swings out for quick, easy change. All motors are outside the base.

Another Ex-Cell-O feature is the large chip chute, cast as an integral part of the base. There are no openings where chips or coolant can enter the base. Contact your Ex-Cell-O representative or write direct for complete information.

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-52

XLO

At left: The Ex-Cell-O Styled 312 Cam Operated Precision Boring Machine. A smaller model, the Ex-Cell-O Style 308, is also available because of the demand for this type of machine.

Washington ... NEWS REPORT

Military on the rise . . .

The military budget—final details were still being worked out at press time—will be the biggest ever in peacetime. It will show expenditures of about $38 billion, roughly 5% over the current level, and the same total for new money requests. It reflects none of the growing talk about international arms controls. Indeed, pressures have been on the other side—to step up defense spending because of the war threats in Hungary and the Middle East.

Military spending hikes will show up across the board: up about $1 billion in operations and maintenance; a slight rise in research and development; and a boost of nearly $500 million for hardware procurement.

Here's the breakdown on major procurement and production:

• **Aircraft** will show a drop for the fourth consecutive year—down about $300 million to under $6.5 billion. Production of the B-47 medium bomber has been phased out. Its successor, B-58, is still in flight testing, isn't likely to be in operation next year. B-52 heavy bomber production is being kept at 20 monthly, despite loud demands for a speedup. New restrictions on Army aviation will hold down output of troop-carrier and other transports and the "low & slow" lighter planes.

• **Guided missiles** expenditures will hit about $2 billion, a 20% boost from this year. They now make up 8% of Air Force deliveries of aerial weapons, are likely to make up 35% by 1960. Much of next year's increase will go for production of ballistic missile prototypes for testing (actually this is still R&D), the remainder for new missiles becoming operational.

• **Shipbuilding** will show an increase of about $300 million, bringing the total to about $1.3 billion. The increase represents deliveries and progress payments for the Navy's growing fleet of modern vessels. In production next year will be at least 8 nuclear subs, 10 nuclear reactors for a cruiser and supercarrier, at least 2 conventional supercarriers. In addition, five cruisers and a sub are being converted for missile firings; conversions of 4 WW II carriers to larger angled decks will be near completion.

• **Artillery, gun, and ammunition** output will be cut in half to about $400 million.

Automation hearings . . .

Congress got a fresh picture last month of the present status and future of automatic control equipment—along with a host of suggestions from the industries that make and use these devices—about what the government should do to help ease growing pains in the fast-advancing age of automation. The report and suggestions came as a House-Senate Economic Subcommittee held a five-day hearing to get posted on progress since it last looked at automation in 1955.

Highlights of the testimony:

• Congress should allow companies to deduct from taxable income the first $50,000 a year they invest in new tools and plant—making up the lost taxes in a later year of their choice. Robert T Sheen, president of Milton Roy Co, producer of automatic control pumps, said the plan would be a particular boon in helping small manufacturers stay competitive in the face of high costs of financing needed modernization.

• **Application of automation** to both military and commercial needs "is being jeopardized" by needless duplication of research, warned Daystrom Inc president T R Jones. He urged appointment of a "neutral, unbiased group" to help industry reap the benefits of military developments in automation equipment.

• **The need for giving scientists and engineers** a better grounding in basic scientific knowledge (rather than training in soon-obsolete current industry practices) was underscored by Rutgers University Engineering Dean Elmer C Easton and industry witnesses. Design of electronic systems for complete control of a plant's machinery "requires use of incredibly complex mathematical analysis and a thorough knowledge of basic principles" in a wide range of sciences, said Easton.

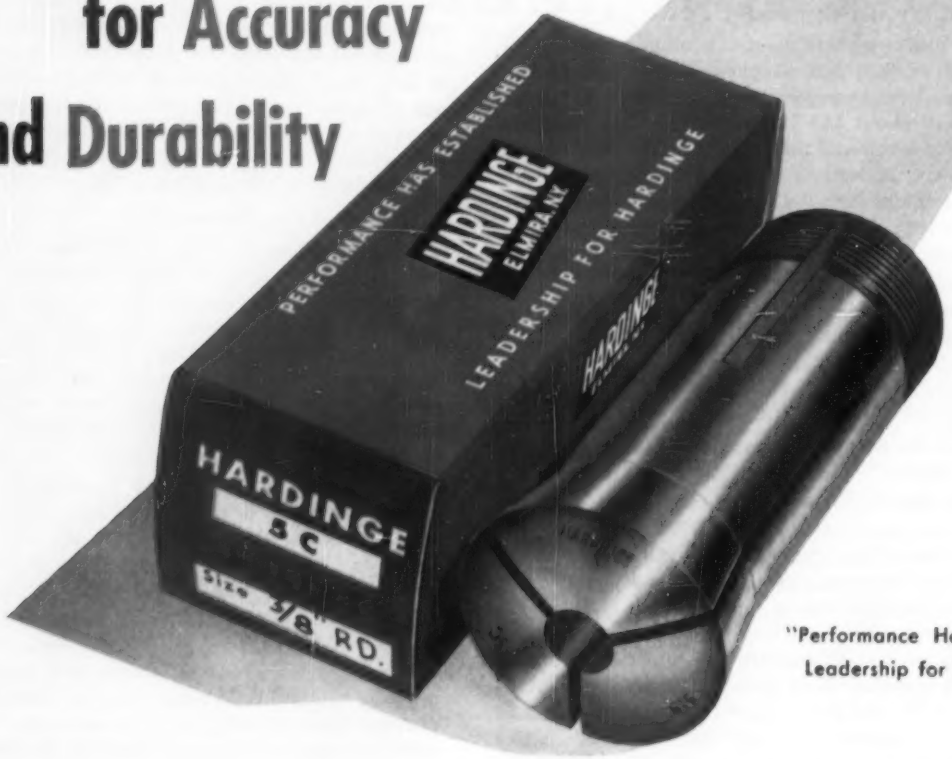
Limits on defense advertising . . .

The Pentagon plans to clamp down on advertising expenses allowed in cost-reimbursement defense contracts. The issue of "government-subsidized" advertising costs came into the spotlight at a recent Congressional manpower investigation. The charge was made that defense contractors are luring engineers from one another and the government itself, claimed that advertising expenses incurred were being charged to the government as allowable costs under contracts.

Right now, contractors can include as allowable expenses personnel recruiting and institutional advertising. There are no dollar limits; Pentagon auditors talk only about "reasonableness" of the amounts allowed. The proposed limitations haven't been spelled out yet. But officials hint that recruiting ads published under the guise of institutional advertising may come under fire.

Specify HARDINGE Collets for Accuracy and Durability

HARDINGE
ELMIRA, N.Y.



"Performance Has Established Leadership for HARDINGE"

For Your LATHES and MILLING MACHINES

HARDINGE Draw-in Collets symbolize accuracy, long life, and low cost because they are hardened and ground both internally and externally, have heat treated threads, — and cost no more than ordinary collets.

HARDINGE Collets assure you of all-essential accuracy plus durability and economy.

Immediate stock delivery from Elmira, Dayton, Chicago, Minneapolis, St. Louis, Detroit, San Francisco, Los Angeles, Philadelphia, Hartford, New York.

Write for Bulletin 56 — complete collet ordering information for all Lathes and Millers.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

Detroit ... NEWS REPORT

Army's fabulous test center . . .

Out in suburban Detroit, the Army Tank Arsenal plant has quietly been gathering a force of highly trained technicians, both Army and civilian, to man its testing center, which insofar as equipment is concerned, far overshadows GM's neighboring Tech Center facilities.

Open to industry as a non-profit testing and research facility, the Army center has come up with some fine efforts. Latest one is the use of salt-carburizing heat-treat for final drive gears.

These tank gears, which are perhaps the most highly-stressed gears to be found anywhere, were formerly made with high alloy steels containing 3 lbs of nickel a gear. Using the salt-carburizing method for heat-treat, Army technicians have been able to eliminate the nickel content entirely, to use lower steel alloys, and to decrease production time by about 25% over gas-carburizing.

And, because the salt process allows absolutely predictable shrinkage and warpage, the Army center has also eliminated the use of quenching dies. The Army thinks that the process will have some applications in industry (salt-carburizing isn't new, but it hasn't been used extensively in production operations) because of its low cost.

The Army also boasts the world's largest cold-room at this installation—a giant structure (70 x 52 ft, with a 21-ft ceiling) that can "soak" materials down to –85 F.

Heavy research is also going on in the newer metals—especially in titanium, which is being tested as road wheel and suspension material.

As 1956 bows out . . .

As the young New Year makes its appearance, the auto production picture begins to shape up a little more solidly than the somewhat optimistic predictions. Most crystal ball gazers are sticking to their 6- to 6.2-million car forecast for 1957. But as of December's end:

Chrysler (all divisions) has a backlog of 400,000 orders, compared to last year's 275,000. As a result, Chrysler top brass is even more optimistic than when models were introduced. Plymouth-Dodge output is being increased 20% at Los Angeles with a second shift. Plymouth's Detroit plants are on a six-day week. Plymouth and Dodge will start framing and assembly operations at the Newark, Del, plant sometime in 1957, with weekly output slated at around 5000 units. DeSoto is doing better than expected, and so are all of Chrysler's luxury models, from the Imperial on down.

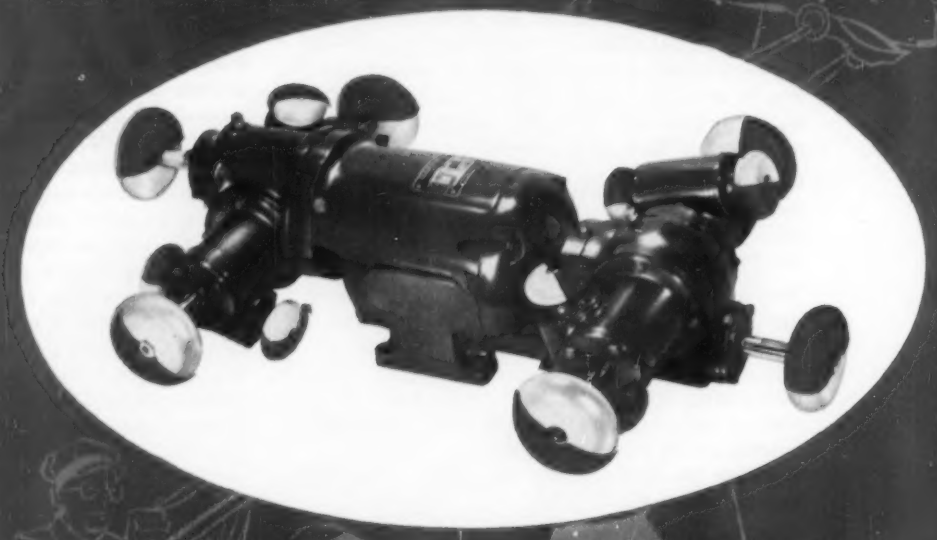
Over at General Motors, where they're notoriously close-mouthed about sales, it's said that Buick sales aren't up to expectations—but part of this is caused by a shortage in dealer showrooms, and by a stringent quality control program that is slowing down output. Result is that Plymouth may nose Buick out of third place. Olds sales, too, aren't up to expectation. But Cadillac continues to roll, with plants working six days a week. Pontiac was crippled by a Fisher Body plant strike, but is now rolling again. The star of the GM stable, Chevrolet, is on a six-day week, but its output dropped off nearly 10% in mid-December. There is fear that Ford may continue to hang on to its early sales lead over Chevvy. Chevrolet will be ready to go into mass production on its fuel injection system by mid-January—and prices will be cut 'way down from the present $484.

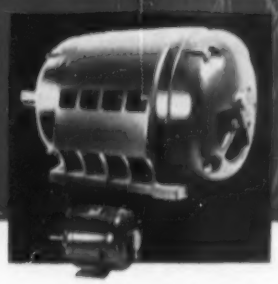
Ford is grinning from ear to ear over its early lead over Chevrolet and officials think they can hold it through the year. Ford is producing and selling at a record pace. Lincoln, the only car last year to break production records, is just slightly behind last year's figures and has an excellent order backlog. Some production trouble with the four-doors has slowed output, however. Continental Mark 88 is on a six-day week to produce 18 cars a week, less than orders on the books. The Thunderbird wound up the year with sales in excess of 20,000, expects to better that in 1957, with a possible engine change to combat Corvette's fuel injection. Mercury is turning out about 8000 cars a week on a six-day week. This means full output well through the first quarter.

American Motors' Rambler got off to a fast start this year, was running well ahead of sales expectations until the last 1957 10-day report caused a rash of long faces at the Detroit plant. Nash and Hudson are staying steady at around 500 cars a week. Rambler is running 2500 a week, hopes to break out of the red in 1957 (1956 losses all told: nearly $19 million). Look for a major styling change in the 1958 Rambler—with money to come off Hudson-Nash tooling.

Studebaker-Packard is shooting at 100,000 units for its share of S-P Corp's goal of 153,000 cars and trucks. Studebaker is selling well and turning out 2100 a week. Packard will be in production at South Bend in mid-January with four-door station wagons.

Why not build the cart before the horses?





Just tell us here at Master what you want in power drives—and get the utmost in flexibility, compactness and performance. It probably won't be as complicated as the multi-shaft Gearmotor illustrated here, with 14 shafts turning at diverse speeds. But, regardless of what you need, Master can supply the right combination of horsepower, shaft speed and mounting features with whatever Master components are required—all combined in one compact efficient unit. Just ask for information.

Motor Ratings. 1/8 to 400 H.P. All phases, voltages and frequencies.

Motor Types... Squirrel cage, slip ring, synchronous, repulsion-start induction, capacitor, direct current.

Construction .. Open, enclosed, splash-proof, fan-cooled, explosion-proof, special purpose.

Speeds..... Single-speed, multi-speed, and variable speed.

Installation.... Horizontal or vertical, with or without flanges and other features.

Power Drive Features..... Electric brakes (2 types)—5 types of gear reduction up to 432 to 1 ratio. Mechanical and electronic variable speed units—fluid drives—every type of mounting.

THE MASTER ELECTRIC COMPANY, Dayton 1, Ohio

NEWS REPORT

Machine tools ...

November sales off . . .

Net new orders for metal-cutting machine tools declined in November to the level of last June and July, according to preliminary estimates.

The total was around $61 million, compared with $66 million in October, $78 million in Sept.

Orders for the year to November 30 add up to $863 million. Unless there was a spurt in sales this month, the drop in November precludes the possibility that the year's orders will equal or exceed 1955's figure of $927 million. Nevertheless, the year was one of the best in peacetime.

Shipments also fell in November. They are estimated at about $79 million, substantially below October's total of $89 million. They bring the 1956 figure, for the first 11 months, to $798 million.

Two factors are a source of worry to many machine tool builders. One is tight money.

What about auto programs? . . .

The other is the conspicuous absence of new big automotive tooling programs.

Up to now, there is slight evidence to support the theory that tight money is having a deleterious effect upon production equipment sales.

Business is to be had in Detroit. But there is doubt whether there will be great gobs of it periodically, as in 1956. Modernization provides a certain volume of machine tool business, but the big push from automotive buyers comes from massive new tooling and expansion programs.

General Motors president Harlow Curtice says that much of GM's $700 million for capital goods in '57 will be spent for advanced technology developed by the machine tool industry. Beyond that statement he has not elaborated.

First half outlook bright . . .

Many builders report that most of their individual sales are small and are widely distributed. One prominent company states that sales are up in the southeast where new plants are starting.

Builders and distributors almost to a man are optimistic about the outlook for the first half.

Outstanding quotations are in very large volume. They cover many large expansion and modernization programs. Specially-tooled production machines are in the vanguard.

Sheffield acquired by Bendix . . .

News that Sheffield Corp has been acquired by Bendix Aviation and would be operated as a subsidiary of the latter came as a surprise to the machine tool and the precision instrument industries. This is not the first time that a merger such as this one has been made affecting a production equipment company. Both Clearing Corp and Axelson Mfg became subsidiaries of U S Industries Inc, and recently Hydraulic Press Mfg Co was taken over by Koering and is run as a subsidiary of it. Story is on page 110.

Bullard buys Hydra-Feed line . . .

Bullard Co, as a move toward further diversification, has bought the Hydra-Feed line of automatic and tracer-controlled lathes from Hydra-Feed Machine Tool Corp, which will be liquidated the coming year. The new line will be made at Bridgeport. Story is on page 111.

Cone's British plant operating . . .

Manufacture of Cone automatic bar and chucking machines is under way in England in a new factory at Aldridge, near Birmingham. The factory was built and is operated by the Cone Automatic Machine Co Ltd, wholly-owned British subsidiary of the Cone Automatic Machine Co.

Employing around 100 workers at the start, the new factory is on a seven-acre site, which is ample for future planned expansion.

The British company has a complete engineering department and a service department for handling business in the United Kingdom and Continental Europe.

Recently, Cone held an international conference and a showing of its machines for its Continental and other foreign agents at the new plant.

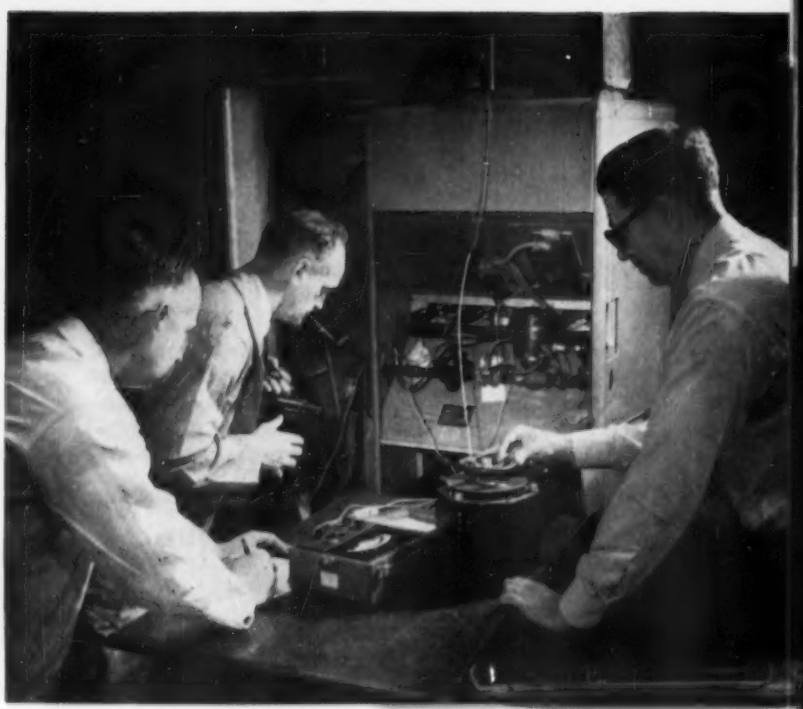
$150 million for replacements . . .

Army, Navy and Air Force have asked for a combined total of $150 million for machine tool replacements for fiscal 1958 (beginning next July 1). Defense Department, however, has not yet revealed exactly what sum will be included in the appropriation request to be submitted to Congress next month.

Army and Air Force are still working out their own tool replacement formulas. Each service will be permitted to apply its own formula. A uniform formula to be used by all three services is improbable in either fiscal 1958 or 1959.

BF

THE ELECTRIC COMPANY, Dayton 1, Ohio



Blowing hot, cold and sky-high!...

There are many sides to Surface—the Surface Combustion Corporation, Toledo, Ohio. Above, they're building industrial furnaces, gas generators and glass lehrs in the Toledo plant main bay. Right, it's an air-conditioning equipment test in a Columbus laboratory. And from its various divisions—Surface, Janitrol, Kathabar and Webster Engineering—also come aircraft and automotive heating systems; heat process equipment for glass and ceramics; dehumidification systems and boiler burners, slab heaters, annealing covers and soaking pits; and heat treat furnaces of all types from small laboratory furnaces to the largest field-erected units.

Bendix Aviation and would be operated as a

Your story in

American Machinist

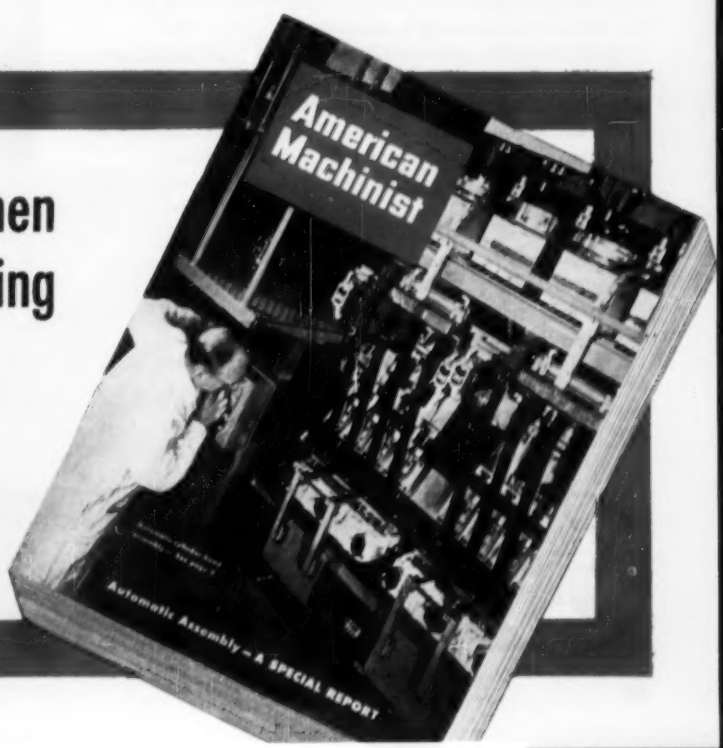
sells more to the men who buy more

at Metalworking plants such as Surface Combustion Corporation where 86% of purchase dollars goes for machinery, materials, parts and supplies needed for production.

Your customers and prospects at Surface Combustion and its sprawling subsidiaries really have to "think big" in their buying. And it's the typical wide-span purchasing responsibility of today's Metalworking company production executives and engineers. They have tremendous buying to do—*important* buying under the pressure of time and the need to select from many competing products.

What happens when your sales messages go into *American Machinist?* You reach 38,000 subscribers—front rank Metalworking production men who count on the interest and validity of *American Machinist's* editorial and advertising pages. You make low-cost sales calls that get attention, time and consideration. You talk to—and sell—the men you *have* to sell... the production engineers and executives who have the major voice in Metalworking buying decisions.

And you know they *want* to be sold in *American Machinist*, because it's their *first-choice* magazine in the field!



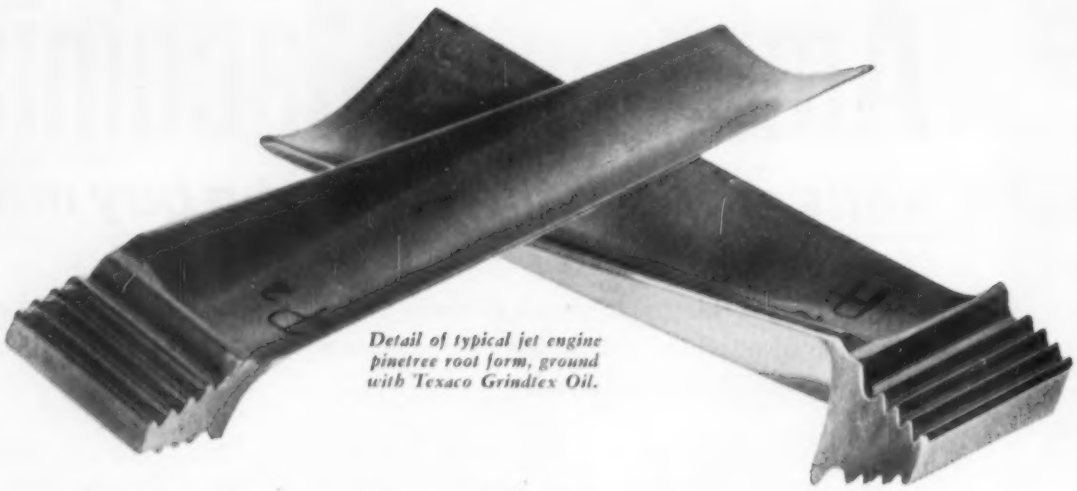
...bought by the men who buy for metalworking

The McGraw-Hill Magazine of Metalworking Production

ABP

ABC

McGraw-Hill Building,
New York 36, N. Y.



Detail of typical jet engine pinetree root form, ground with Texaco Grindtex Oil.

Grinds more "pinetrees" between wheel dressings

UTICA DROP FORGE is one of the country's top producers of jet engine blades—doing the complete job from vacuum-melting the alloy to precision forging and finishing.

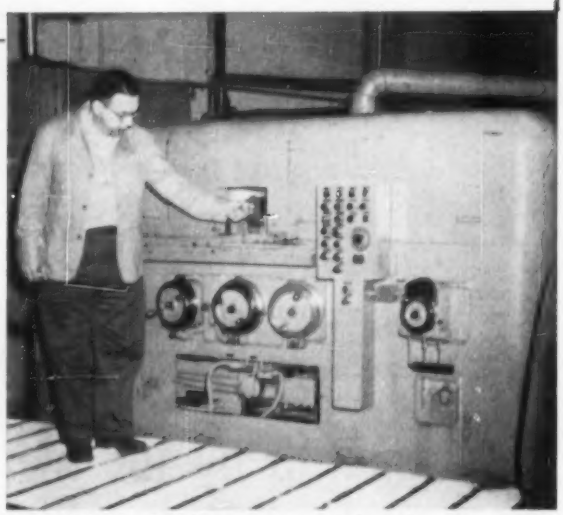
For the critical form grinding of pinetree and dovetail roots, as well as air foil contours, a Texaco Lubrication Engineer recommended *Texaco Grindtex Oil*—and its use has proved outstandingly successful.

Utica Drop Forge finds *Texaco Grindtex Oil* an important help in holding to the required close tolerances and achieving consistently excellent finish. Wheels last longer and fewer dressings are needed. These benefits add up to a higher output of perfect parts at a lower unit cost.

Be sure you're getting the most from *your* machines. There is a complete line of *Texaco Cutting, Grinding and Soluble Oils* to help you do *all* your machining better, faster and at lower cost. A Texaco Lubrication Engineer will gladly help you select the proper ones.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.



One of the Ex-Cell-O Precision two-wheel form grinders at the Clayville, New York, plant of Utica Drop Forge & Tool Corporation. Adapted Norton and Thompson grinders are also in use. Metals worked are Nimonic 80 and 90, Iconel 700, Stellite and stainless steels. *Texaco Grindtex Oil* is doing a great job here.

TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

What's ahead ... in Metalworking

First quarter to outperform 1956 . . .

The first quarter promises to outperform any quarter of 1956 in metalworking output.

American Machinist Index, based on manhours worked, has risen 13 points since last May and now is at a peacetime high of 181 (with 1947-1949 as 100). The index, in fact, is not far from the wartime peak reached in 1943.

Support for this sterling record is coming from all corners of Metalworking. Nevertheless the weakest element still is the automotive industry, which is predicting a fairly modest gain over 1956's disappointing total.

No slackening in capital goods . . .

The heavy-goods industries continue to provide the strongest activity of all. Their order books are, with minor exceptions, jam-packed, and production in 1957 is almost certain to exceed the 1956 mark.

Electrical machinery demand is very good. Makers of massive units are booked solid through the coming year and well into 1958.

Contract tool and die people have just completed their best year. Shipments were 43% above the 1955 figure. New orders have gone back up recently to the volume enjoyed in June, which was the high month of the year.

Big tooling orders for 1958 models are being placed by auto makers. The electronics industry is reported to be a steady customer. A sharp upsurge in business is expected as the guided missile program expands. Shops in Ohio, Milwaukee and Chicago areas are doing well. New England companies also are busy. Tool and die industry is betting that 1957 will just about equal 1956 which was a plush year.

Screw machine products industry, with backlogs staying pretty constant at 6 to 8 weeks, is approaching 1957 with some uncertainty.

Business from Detroit has not developed to the extent anticipated. And the outlook in household appliances and in housing is not too promising, in demand for screw machine products.

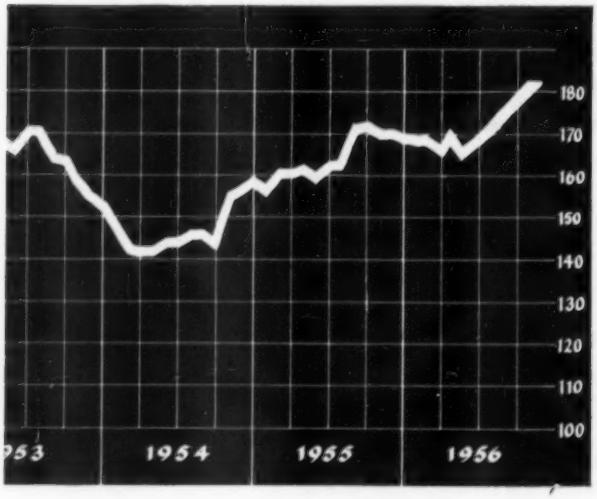
Steel casting companies are assured of full production during the first half of 1957. Bright on the horizon is a continuation of the railroad-car building program.

Construction of oil tankers also would stimulate the steel-castings business.

Backlogs for steel castings run 3 to 4 months, but orders for long delivery dates are included, so that a true figure for unfilled orders would be nearer two months.

Auto parts makers estimate that first quarter production will be 5 to 8% better than the fourth quarter, which in turn was up 10% from the third quarter. Detroit, however, is gearing its output of cars closer to retail sales than in many years.

The aviation industry is in an expanding period. Orders have piled up to huge proportions, and the main problem in 1957 will be production rather than sales. This situation shows up all along the line—among engine and other components producers as well as among airframe companies. Many aircraft parts makers say that they have more than a year's work on hand.



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	DEC. Estimated	NOV. Preliminary	OCT. Revised	NOV. Year Ago
Total Index	**181**	**180**	**177**	**172**
Machinery	154	156	143	
Electrical Machinery	218	218	198	
Autos	149	113	176	
Other Transportation	325	355	275	
Other Metalworking	147	150	143	

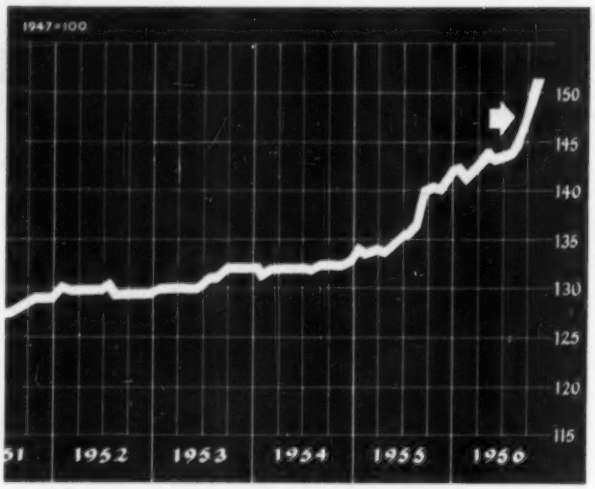
NEWS REPORT

What's ahead . . . in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	DEC. Estimated	NOV. Preliminary	OCT. Revised	NOV. Year Ago
Total Index	**152.0**	**151.0**	**149.1**	**140.9**
Metalworking Machinery	174.1	172.4	158.1	
Other Machinery exc. Electrical	158.3	157.3	147.4	
Electrical Machinery	149.6	149.1	136.8	
Fabricated Metal Products	144.2	141.4	135.9	

152



Consumer spending to be strong . . .

Consumer spending may well be the most dynamic factor in the national economy next year. It is the factor most likely to grow in strength as the year goes on.

There are two main reasons. Incomes are rising, and people are paying off debt.

Employment promises to be higher in 1957 than this year. Many of the 1955 and 1956 wage agreements contain provisions for further increases next year.

Another six to nine months of gains in income will have the effect of making consumers more optimistic and of adding to their willingness to buy. These factors will apply particularly to farmers, auto workers and others who have not done so well in '56.

Much of the overload of installment debt, acquired during the 1955 spree, will be worked off before 1957 is out. As a result, a new upswing in credit purchases is possible late in the year.

Spending on soft goods and services of all kinds is set to continue in a steady uptrend.

Consumer spending, in fact, may have risen as much as $15 billion in 1956, even while consumers keep up a high rate of savings. Spending may go up faster during the year ahead.

The business boom showed some signs of faltering the past year. That was especially true in housing and in consumer durables.

It was sustained, however, by the terrific strength of the demand for durable goods.

In 1957, it appears that business activity will be better balanced and stronger, with government, business and consumer spending all helping.

The main point is that a year of high activity opens up ahead.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	154.8	153.6	150.7
Steel ingot operation (thousands of tons)	2,511	2,522	2,338
Electric power output (million Kilowatt hours)	12,220	12,047	11,602
Production of automobiles and trucks	198,163	202,290	203,868
Engineering construction awards (Eng. News-Record—millions)	$456.6	$528.1	$458.4

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949=100)*	147	146	143
Index of durable manufacturers' production (1947-1949=100)*	166	164	161
Durable goods manufacturers' sales, millions*	$14,193	$13,692	$13,261
Machinery manufacturers' sales, millions*	$ 4,120	$ 3,945	$ 3,472
Durable goods manufacturers' new orders, millions	$14,535	$14,266	$14,094
Machinery manufacturers' new orders, millions	$ 4,354	$ 4,200	$ 3,929

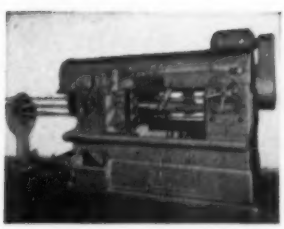
* Seasonally adjusted

First with NEW "Automatic" Service

Cone was the first builder of multiple spindle automatics to provide machine users with an experimental service in the application of carbide tools.

This service is a practical means of determining the possibilities of carbide tools for production men without loss or interference with their regular production schedules.

A pamphlet "FOUR STEPS WITH CONE" describes this service. Send for your free copy.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

Independent Armco Distributor

averts plant shutdown with two-hour delivery

A vital part failed, threatening a metal fabricator with total shutdown. Experience told him what to do. He quickly phoned the part specifications to his Armco Steel Distributor. Two hours later the flame-cut plate he needed was at the airport, where it was picked up by his plane. A costly shutdown was averted.

"Rescue" service, illustrated by this actual case, is only one of the valuable jobs performed by independent distributors of Armco Steels across the country. Even more important, they feed steel to the many thousands of small manufacturers so necessary to the healthy growth of the American economy. Big companies benefit, too, from prompt, efficient warehouse service.

Free Storage Space

By serving as rent-free stockrooms for manufacturers, independent suppliers of Armco Steels free storage space and inventory capital for profitable investment in new equipment. Since they supply steel "custom-tailored" for each buyer, scrap losses are cut down too.

Simplify Buying

Armco Distributors' great variety of stocks makes them shopping centers of industry—helps eliminate complicated and costly many-source buying. They carry complete stocks for their customers of one or more of these Armco Special Purpose Steels:

Stainless steels, Armco ZINCGRIP® and ZINCGRIP PAINTGRIP® Steels, Armco Enameling Iron, Cold Rolled PAINTGRIP, Welded Steel Tubing, Magnetic Ingot Iron and Electrical Steels.

By making these and other basic steels and steel products readily available, Armco Distributors from coast to coast help keep industry supplied and paychecks full. Make it a point to become acquainted with the independent Armco Distributor in *your* community.

ARMCO STEEL CORPORATION

2256 CURTIS STREET, MIDDLETOWN, OHIO

SHEFFIELD STEEL DIVISION • ARMCO DRAINAGE & METAL PRODUCTS, INC. • THE ARMCO INTERNATIONAL CORPORATION

American Machinist

MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

You Will Be Better Off

Well, here we are, on the brink of a New Year. Just what are we about to plunge into?

It is a safe guess that a year ago few if any of us were so clairvoyant as to foresee the big events of 1956—the Suez crisis, the Hungarian rebelliion, the overwhelming Eisenhower victory, the Andrea Doria sinking, the tremendous upsurge in the American economy, and Elvis Presley.

You should be accustomed . . .

by now to reading, at the beginning of each year, platitudinous statements about our being in the most critical period in history and about the decisions ahead determining our destiny for at least the next generation.

We do not pretend to any preferred status as a crystal-ball gazer on global happenings or on national events. Your guess is as good as ours.

Metalworking is our business and we intend to stick to it. It is hazardous enough to indulge in predictions in that field alone and still prove to be right. So instead of pontificating on events to come, we should like merely to take advantage of the present timing to call your attention to a few things.

First of all, we suggest . . .

that you stand off and take a good look at what's happening in Metalworking. It has grown in physical volume like Topsy. It is twice the size today that it was ten years ago. And it is not through growing. It is likely to be bigger a year from now than at present. It will be a lot bigger by 1960. What are you doing to take advantage of this long-term growth trend?

It is hardly news any more that technological advances are being made so fast that they almost tumble over each other. What was up-to-date manufacturing practice yesterday will be out-of-date tomorrow. President Harlow Curtice said recently that General Motors will spend in the coming year the better part of $700 million to put to use new production technology. You may be a pigmy alongside General Motors, but the question is pertinent, "What are you doing to apply the new technology in your shop?"

Costs of almost everything used in your business are rising. Wage rates are soaring and will go higher. Materials prices are up and will be on an ascending scale for some time. Competition is rugged. Do you have any long-term, continuous plan for keeping your costs down and staying competitive pricewise?

Are you organized . . .

to learn promptly about new technological developments—in machines and in materials? How well informed is your supervisory group about what you are doing and why? Do you have any satisfactory means of transmitting information about the company to all of your employees? How do your people feel about the company and about their jobs? Is your shop clean and a nice place in which to work? Is your equipment antique or modern?

These are only a few of the questions that come to mind immediately, all of them having a serious bearing on your business in 1957 and in the years beyond. Without the formality of making New Year's resolutions, which usually last only a few days or weeks at best, why don't you look into these questions and find out where you are. If you do, you will be better off at the end of 1957 than at the beginning.

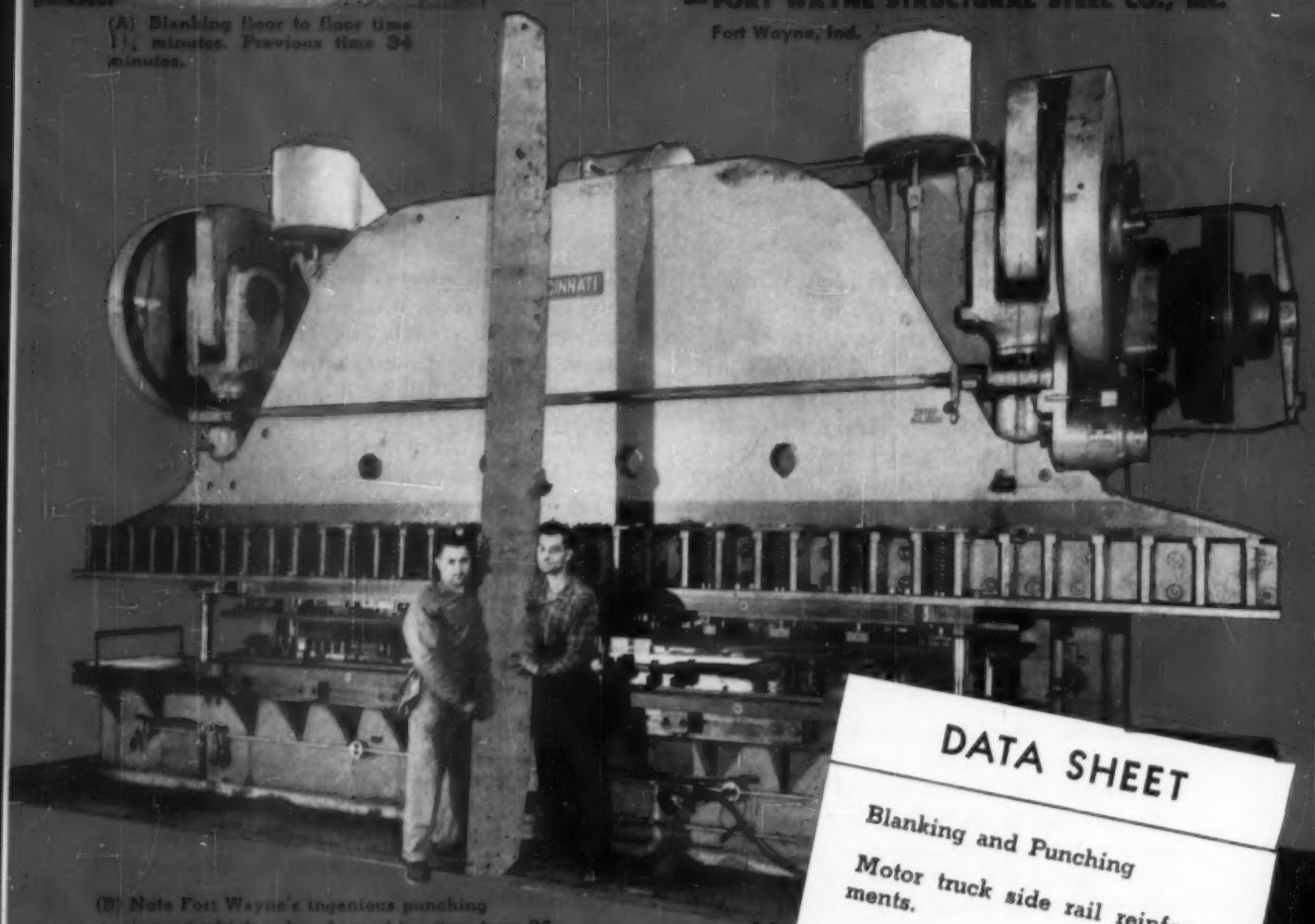
Burnham Finney EDITOR

70 minutes cut to 2.6 minutes

on combined blanking and punching operations!

—FORT WAYNE STRUCTURAL STEEL CO., Inc.
Fort Wayne, Ind.

(A) Blanking floor to floor time 1½ minutes. Previous time 34 minutes.



(B) Note Fort Wayne's ingenious punching equipment which reduced punching time from 36 minutes to 1⅓ minutes and took advantage of every versatile Cincinnati feature.

This versatile Cincinnati All-Steel Press Brake, 34 Series x 16′, has revolutionized the production of these long motor truck side rail reinforcements.

Write Department A for Catalog B-4R.

We also suggest you check with our Application Engineering Department on the use of a versatile Cincinnati All-steel Press Brake in your shop.

DATA SHEET

Blanking and Punching

Motor truck side rail reinforcements.

Operation (A) Blanking ¼" C1010 Steel 202" cutting edge. Floor to floor—1¼ minutes. Previous time—34 minutes.

Operation (B) Punching 130 holes per stroke. Floor to floor—1⅓ minutes. Previous time—36 minutes.

John L. Hayner
President

Photos courtesy—FORT WAYNE STRUCTURAL STEEL CO., Inc. Fort Wayne, Indiana

CINCINNATI

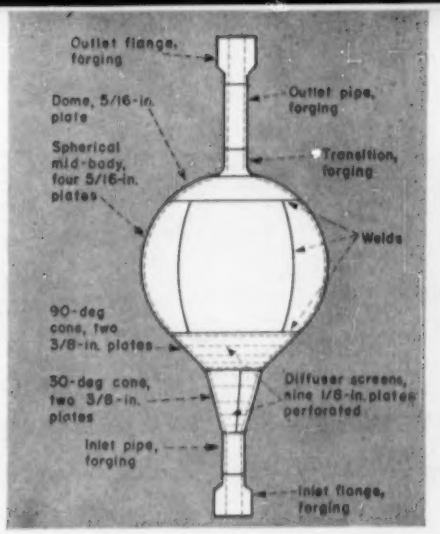
THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

American Machinist

WELDING ZIRCONIUM requires special techniques

*W R GALL OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN



CORE VESSEL . . . for nuclear reactor is built up from formed zirconium plate 5/16 to ⅜ in. thick, and machined forgings. All joints were welded with zirconium wire, using helium shielding

Welding heavy zirconimum plate and forgings for an atomic reactor vessel, in the open, posed some unusual problems in shielding and joint preparation

Fabrication of a zirconium vessel for the core of a nuclear reactor involved a completely new approach to the problems of zirconium welding. The material, Zircaloy-2, is a zirconium-rich alloy containing 1.5 to 1.65% tin, 0.1 to 0.17% iron, 0.07 to 0.14% chromium, 0.05 to 0.07% nickel, and a maximum of 0.009% nitrogen. It is extremely active chemically and requires complete exclusion of the atmosphere by inert-gas shielding to prevent contamination at welding temperatures. Welding of such material has been done in controlled-atmosphere chambers, but not in thicknesses requiring filler metal in the joint, Construction of such a chamber was considered but, in view of the size of the work and the difficulties involved, it was decided to develop equipment and techniques that would permit all welding to be done in the open.

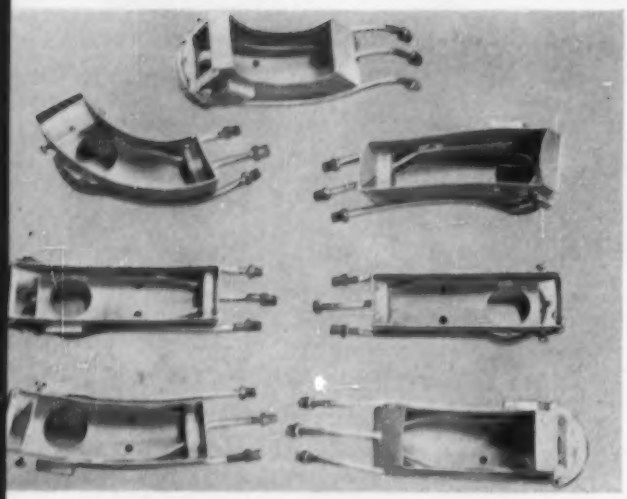
Shielding presented the most serious difficulty, and it was found that argon tended to produce more porosity than helium as the primary shielding gas. Energy input and gas nozzle design were also found to be quite critical in this respect. To avoid atmospheric contamination, it was necessary to blanket the weld puddle, the heat-affected zone, and the completed weld above 1000 F with the inert gas, and this necessitated the construction of individual shields for each weldment geometry. Gas was supplied at the torch and behind it, and water-cooling was provided for the flexible diaphragm surrounding the joint between torch and shield. Small notches in the edges of the shield permitted gas to escape and prevented inspiration of outside atmosphere. For backup, hollow copper bars were made to conform to the shape of the inside of the weldment and were provided with regularly spaced holes to maintain a positive gas flow. For tubular and conical sections, both ends were plugged, and gas piped continuously to the interior, escaping through small vent holes.

All welds were made downhand, and the shield, carrying the torch and tungsten electrode, was spring loaded to maintain pressure against the work surface. The torch was held stationary, with the work rotated on a welding positioner or moved laterally on a machine carriage.

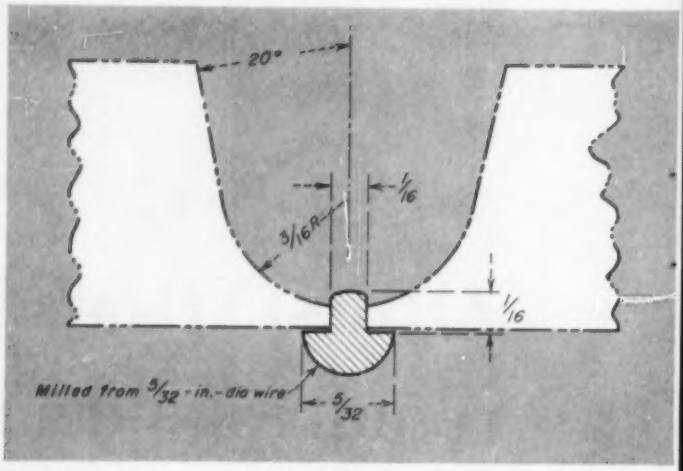
Cleanliness and good fitup were found to be highly important, and all machined and ground surfaces were brushed with stainless-steel brushes to remove burrs, then cleaned with acetone to remove all traces of grease or other contaminants. The area in the vicinity of the joint was also ground to remove all oxide film for a distance of about 1 in. from the machine edges, then cleaned with acetone.

The first step was to insert and tack weld a special insert made by machining both sides of a 5/32-in. wire to form a tongue 1/16 in. wide by 1/16 in. high. This was tacked to the root nose of one of the pieces, then both parts were brought together under pressure to minimize clearance between the base metal and the insert. Tack welds were made every half-inch, without filler metal, by fusing a small area of the top of the in-

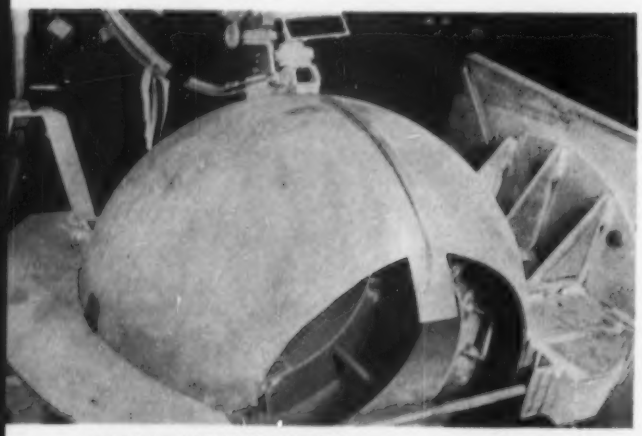
*Based, on a paper prepared by L F Bledsoe, F V Daly, G E Elder, W R Gall, and E C Miller for the American Welding Society, and a paper by G E Elder, E C Miller, L F Bledsoe, and F V Daly for the American Institute of Mining and Metallurgical Engineers.



TYPICAL GAS SHIELDS . . . designed to fit individual joint geometry. Center tube is for gas supply, side tubes for circulating water for cooling flexible diaphragm around torch connection



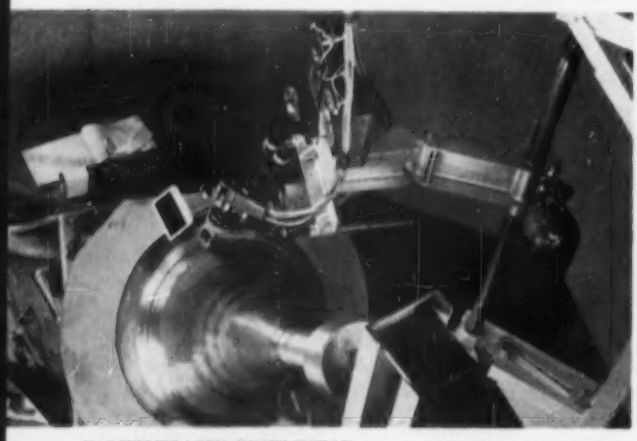
FIRST STEP . . . in making weld consisted of preplacing specially formed filler wire and tack welding every ½ in. by fusing the shank of the insert to each side of the joint



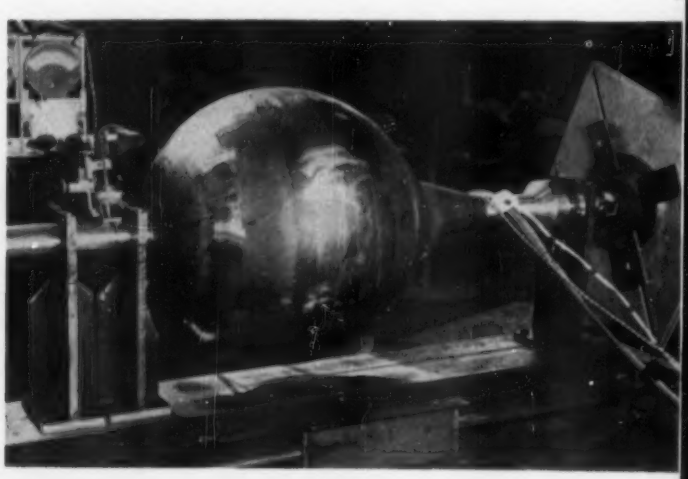
LONGITUDINAL WELD . . . on cylindrical portion of vessel required special fixture on weld positioner. Note start and runoff tabs to be machined off at later operation

sert to each side of the joint, using a Linde HW9 torch with a 1/16-in. tungsten electrode and a No 5 gas cup. Gas flow was about 20 cu ft per hr. After each tack was completed, the cup was held over the fused area until it had cooled sufficiently to prevent atmospheric contamination. The root side was protected by a flow of inert gas over the under side through the backup bar.

Before running the first bead, end tabs of preformed Zircaloy-2 were welded to the ends of each seam in an area which was later removed by machining. Where possible, materials were sized to allow approximately 1/16 in. of extra width to provide for transverse shrinkage across each joint during welding. Joints were again cleaned by brushing and swabbing with acetone, and the first bead run along the full length of the joint in one continu-



DOWNHAND WELDING . . . for joining 90° cone to base of spherical body is achieved with this special fixturing on a welding positioner



FINAL WELD . . . consists of joining outlet pipe forging to forged transition piece

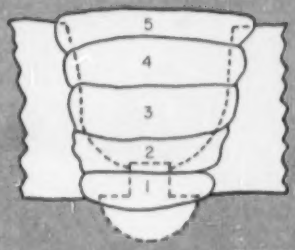
Gas flow on torch:
Helium - 40 cfh

Gas flow on back-up:
Helium - 65 cfh

Gas flow on trail
Helium - 85* cfh

* Except: First pass: 65 cfh
Fifth pass: 100 cfh

Bead No.	Arc length (volts)	Weld current (amp)	Welding speed ipm	Size tungsten (in.)	Weld cup No.	Filler wire (in.)
1	19	110	4	1/16	4	(insert)
2	23	150	7	3/32	6	3/32
3	23	180	6	3/32	6	1/8
4	23	190	6	3/32	6	1/8
5	24	190	5	3/32	6	1/8



TECHNIQUE EMPLOYED . . . for typical gas-shielded weld in zirconium, Zircaloy-2

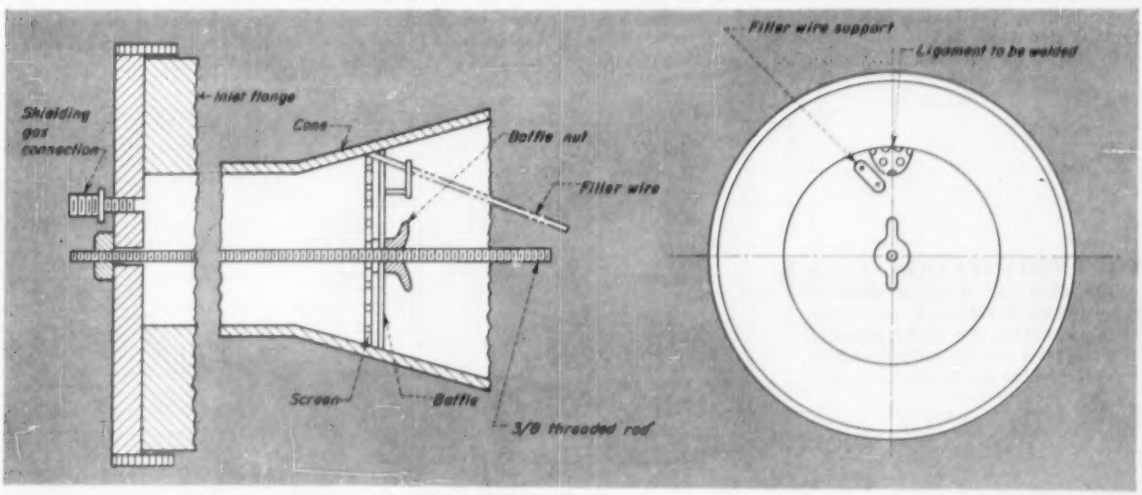
ous pass. The weld was cooled, and any oxide was completely removed by stainless-steel-wire brushing before making the next pass. This procedure was followed for a total of five passes.

Welding was done by two operators. One manually fed the filler wire into the weld puddle through a small hole in the glass window at the front of the shield, maintained proper transverse position of the electrode by means of the horizontal torch rack handwheel, and also controlled the welding current contactor by a foot switch. The other operator maintained the proper arc voltage with the vertical torch rack handwheel, controlled the welding current with a remote-control switch, and operated the controls for work movement.

Filler wire was swaged Zircaloy-2 which was furnished with a clean surface and was cleaned with acetone just before use. The first pass was made with 3/32-in. wire, subsequent passes with 1/8-in. wire. After all welding was completed, weld reinforcement was removed by grinding, and all surfaces sanded to a smooth contour.

Perforated diffuser screens inside the vessel were welded manually, inert gas for backup and shielding being fed through a plug in the base and retained by a baffle positioned just above the weld area.

After fabrication, a comprehensive dimensional check was made of the exterior, and thickness measurements were made by using a calibrated audigage. Two dimensional checks were made, one before and one after hydrostatic testing. The hydrostatic test was made at 775 psig max, with strain gage readings made at increments of 100-lb pressure. The tank was then Freon leak tested by using a GE detector.

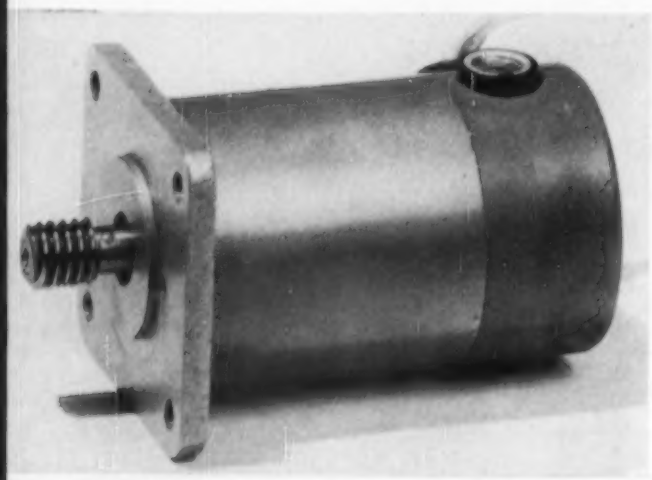


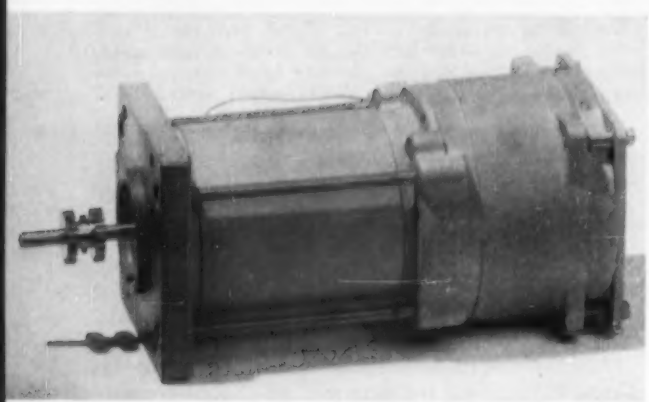
GAS SHIELDING . . . for manually welding diffuser screens inside vessel is provided by plugging the lower end and providing a removable baffle plate to suit the ID of the work

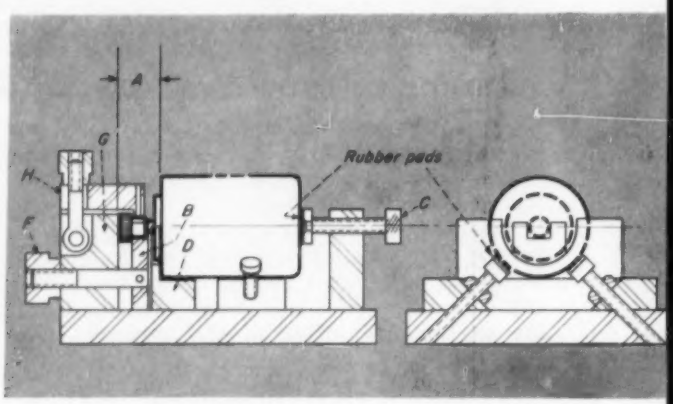
Fixtures aid

ALLAN YOUNG, tool design engineer,
COLLINS RADIO CO, CEDAR RAPIDS, IOWA

In pinning small assemblies such as gears to motors, and gears, cams and couplers to shafts, etc, the problems are the same as for any other drilling operation plus many complications. The three basic functions of the drill jig or fixture are obviously required: The fixture must locate the assembly, clamp it in place, and provide bushings at proper location for each drill. But, because the assembly consists of two or more loose parts being fitted together, the basic functions of the tool are more difficult to provide







COMMON ASSEMBLY PROBLEM: To locate gear on motor shaft at dimension *A* from endframe and drill pin hole. Motor endframe is presumably butted against a locating surface at final assembly of product. Hence, adherence to dimension *A* will properly locate the pinion.

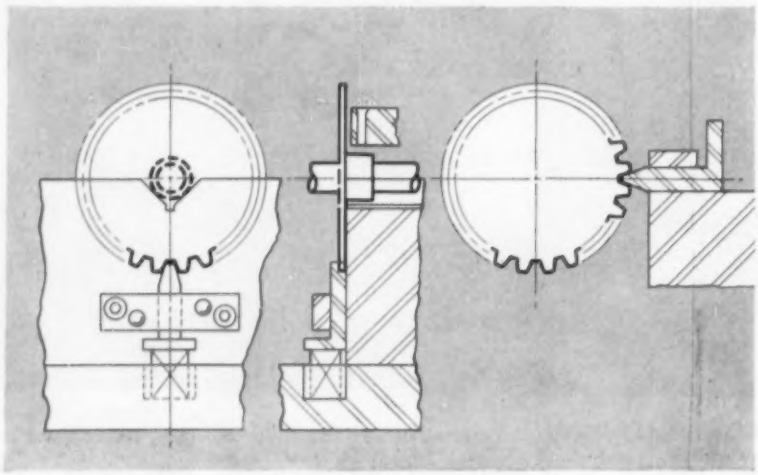
Assembly sequence: gear is slipped on shaft; motor is laid upon rubber pads. Hub of gear rests in the sliding slot block *B*. Motor is clamped by turning swivel screw *C*, until mounting face contacts stop block *D*.

By moving the slot block *B* to the left, by means of the thumbscrew *F*, the gear is brought against stop *G*. Now dimension *A* is established.

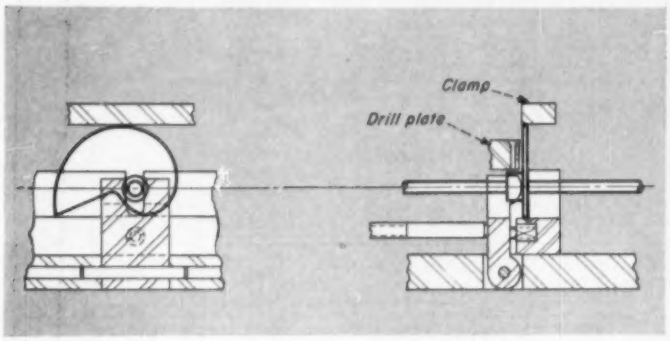
To drill the pin hole, the combination clamp and drill plate *H* is swung into place and clamped by means of thumb nut and eyebolt. Two pins (not shown) are a slip fit into slots on either side of the stop block to hold the drill plate in vertical position.

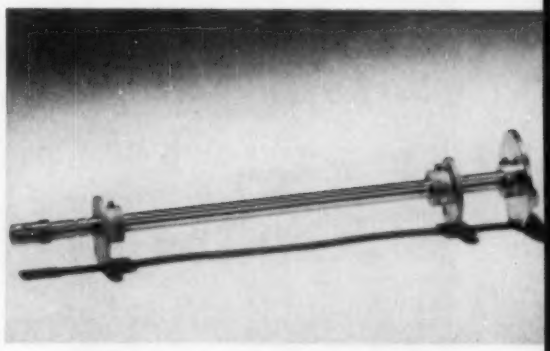
A slot block is better than a V-block, when it is used as a stop block or sliding clamp. The shoulder on the part will bear against the side and end of the slot block, and only against the two sides of the V in the case of the V-block

PART ORIENTATION. Various means exist for orienting gears or detent wheels in relation to each other, or to some other part of the assembly. The positioner may be spring-loaded or hand-operated to position the tooth space

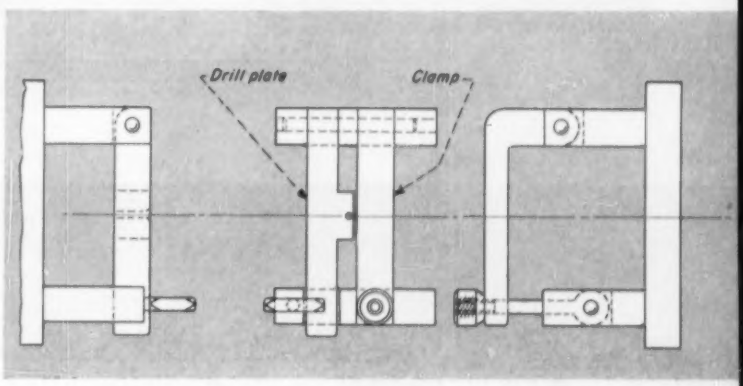


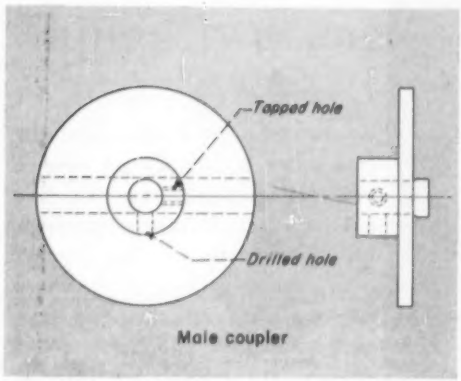
pinning of accurate assemblies

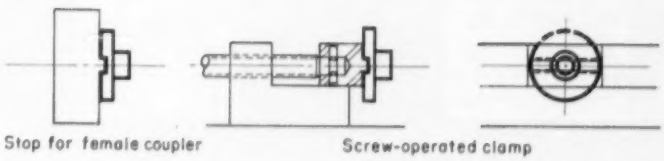


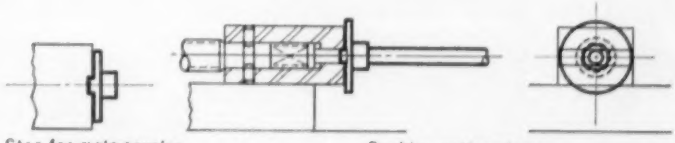


LOCATION OF CAMS IN PARALLEL. Each cam is clamped downward against a locating surface, resting on edge across the lobes. Proper spacing between cams is obtained by forcing the face of one cam against the vertical face of a stop, by means of a horizontal clamp. Details are given for a typical clamp and drill plate assembly for a suitable fixture







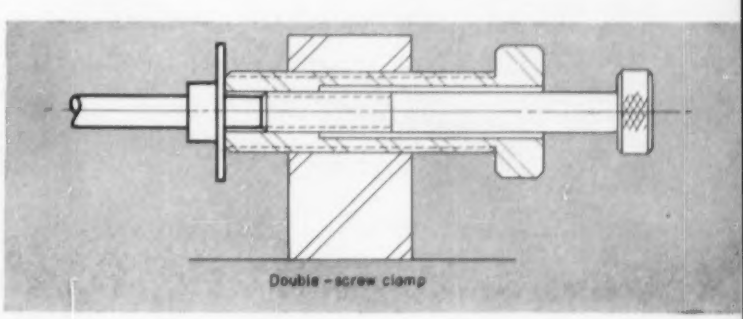


COUPLER LOCATORS. A coupler is a disk with a hub on one side and either a locating slot or a tongue on the opposite side. In making this part, one hole is drilled and tapped in the hub, and a small hole is drilled at right angles to the first hole, to act as a guide when drilling the pin hole through a shaft.

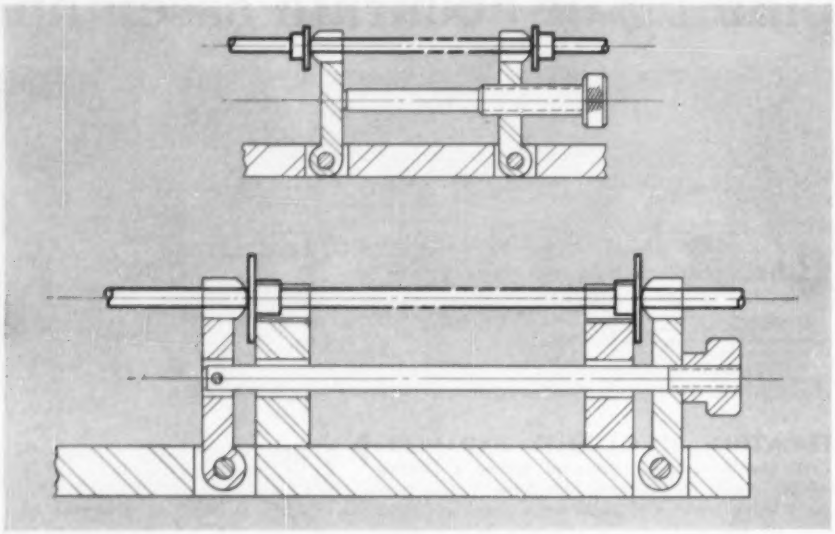
STOP BLOCKS: To position male or female couplers a simple stop block with a vertical slot or tongue can be used. The coupler merely slides down over the mating stop block, and the previously drilled hole is used as a guide to drill through the shaft and the remainder of the hub.

CLAMPING-TYPE LOCATORS: A movable block with a horizontal slot or tongue can be used to clamp the coupler. The positioning block slides on a flat surface to maintain height location.

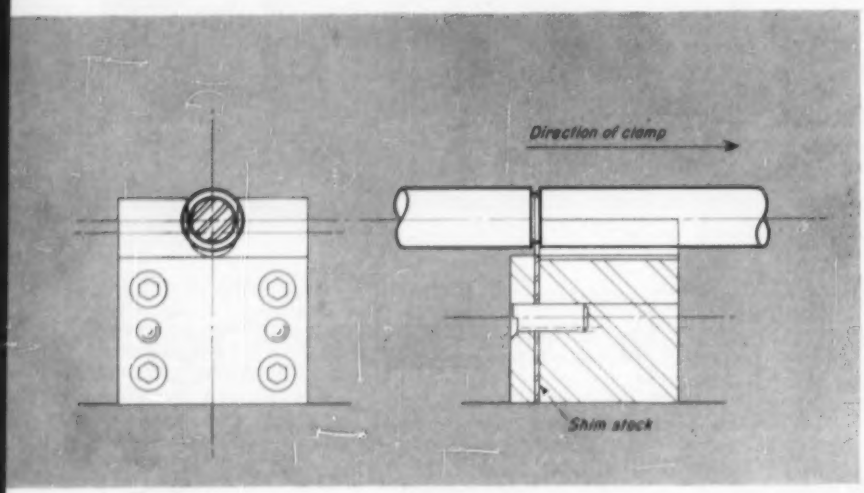
Clamp locators can operate in several ways. A simple device (for a female coupler) involves merely a screw-actuated clamp. The double-acting clamp for a male coupler incorporates a spring-loaded pin that clamps the shaft against an end stop independently of positioning of the coupler. Another double-acting clamp involves a screw within a screw. The outer screw is tightened first to position and clamp the coupler; the inner screw is then tightened to position the shaft

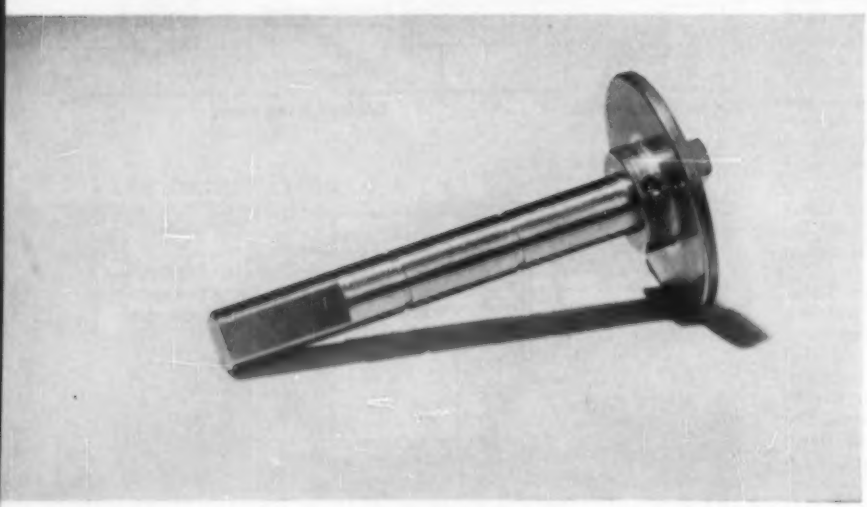


Fixtures aid pinning of accurate assemblies . . .



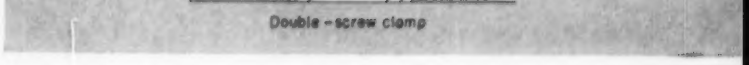
Double clamping arrangement. Parts that are to be positioned on a shaft in relation to each other (and to other parts on the shaft) can be located with a double-clamping arrangement. The clamps can be arranged to push the parts outwards or inwards to locating points



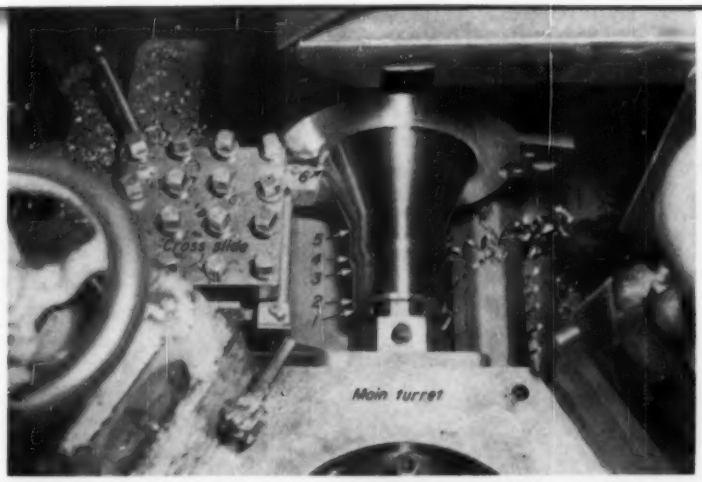


Ring-groove locator. Often a part must be located on a shaft in relation to a ring-groove. The fixture element locating the ring-groove should be a V-block for shaft support and a piece of shim stock fastened to the end of the V-block. The shim stock should be thinner than the groove, and the U-shaped slot in the shim should clear the bottom of the groove and not interfere with shaft support by the V-block.

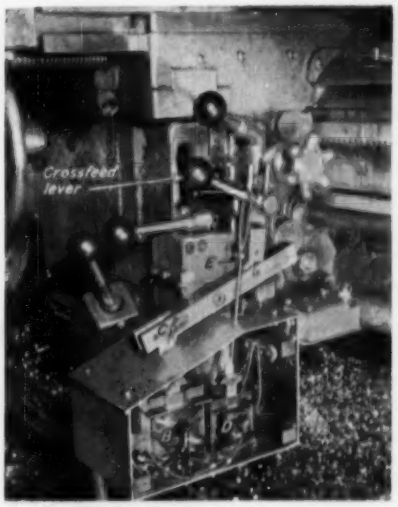
In operation, the shaft is forced against the shim stock locator (on the correct side of the groove) by a torque-type thumbscrew. It is imperative to use a torque-type thumbscrew, because other types of pushers on the shaft would distort or break the shim-stock locator. As with all drilling and pinning operations, all clamps, thumbscrews and nuts should be kept in a position to be operated with one hand where feasible



outer screw is tightened first to position and clamp the coupler; the inner screw is then tightened to position the shaft



Part is a steel forging for an automatic transmission, and has identical tapers from 1 to 2 and 3 to 4, but different taper from 5 to 6. Note that turret is simply butted against saddle, forcing it along at same rate of feed



Crossfeed lever is engaged by one solenoid and arm (B and C), and disengaged by another (D and E). Design is such that system can be overridden manually if necessary. Only regular detent holds lever in operating position

THIS TURRET LATHE . . .

Tapers two angles almost automatically

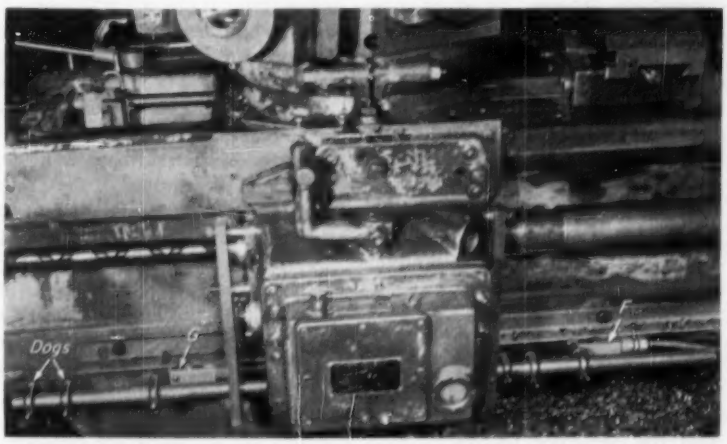
The main turret on a Warner & Swasey 2A operates a boring tool and also pushes along the free-wheeling cross-slide that carries a turning tool. As the turning tool comes up to each taper area, solenoids and limit switches engage the crossfeed at just the right instant to make the machine cut two different tapers . . . an example of a step toward mechanization at Allison Div, General Motors Corp

BEN C BROSHEER, associate editor

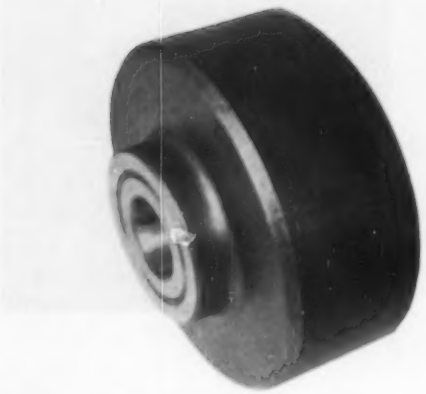
Accuracy in cutting tapers is to ±0.005 with a shop-designed lathe control that allows changing the taper angle to be cut while the carbide tool is turning a straight cut. When the cut starts, crossfeed is geared up for the two identical tapers on the work, and dogs are located to engage the precision switches, solenoids, and feed lever when the tool gets to the correct points on the work. This part of the tapering function works automatically, once the setup is made.

To get the second taper, an operator is required to shift crossfeed gearing on the lathe during the straight cut from points 4 to 5 on the work. After the taper from 5 to 6 is turned, longitudinal feed stops, and the tool feeds straight out, away from the work. When new work is inserted, the operator changes gearing back to the initial taper, and the cycle starts again.

Precision on this operation depends mainly on how accurately the limit switches operate, and how carefully the dogs are located. The partly automatic setup doesn't limit normal machine function, but reduces overall cycle time and allows doubling operations at one chucking of the workpiece. It also reduces tool-approach time and cuts down the number of tools required to complete the work.



Precision switches and dogs at rear of main turret carriage control solenoids. Engagement switch (F) operates from dogs with smaller OD than those that trip disengagement switch (G), so there is no interference between them



Floor-to-floor time on this Gradall roller was reduced from 21.42 min to 8.66 min by a series of five improvements in the operations

Comparison of leaded and regular steels was based on this cross-slide screw. Leaded steel permitted speed increase from 175 to 300 sfpm but produced net saving of only 3.5¢ per piece

How to find the cheapest

Many steps, short of machine replacement, may reduce machining cost. Here are case histories that show how the search for the cheapest method can pay off on relatively small lots—and also how the cheapest satisfactory method may not be the best

ROBERT T HOOK, chief metallurgist, THE WARNER & SWASEY CO, CLEVELAND

The primary objective in all metal-turning work is to remove the maximum amount of stock consistent with good tool life, continued accuracy of the work, and (in most cases) the reasonable finish needed for gaging and subsequent tooling operations.

Major factors which can be manipulated to reduce the machining time on any given part are three: (1) the cutting tool or tools used, (2) the machining methods employed, and (3) the choice of material for the workpiece.

Cutting tools include such items as high-speed steel, the wide range of carbides available, the new nickel-bonded titanium carbides, and the ceramics (Al_2O_3).

Machining methods include use of efficient and fast-cycling machine tools, use of multiple cuts instead of single-point turning, use of carbide "hole pokers" instead of present high-speed steel drills, etc.

Choice of materials for the workpiece cover the range wherein free-machining grades of steel are used to replace standard steel with no sacrifice in the end use of the part.

Of the foregoing, it is obvious that except for the replacement of old machine tools with new (no overnight job!), the most productive approach to cutting costs is to be found in the changes which can be made in cutting tools, in machining methods, and in the choice of material to be used.

CUTTING TOOLS AND METHODS

We have found at Warner & Swasey that a study of methods followed in machining operations may frequently pay off in substantially reduced cost.

On the other hand, many concerns classify themselves as "job shops" and insist that their volume of work is not sufficient to justify the making of specialized studies.

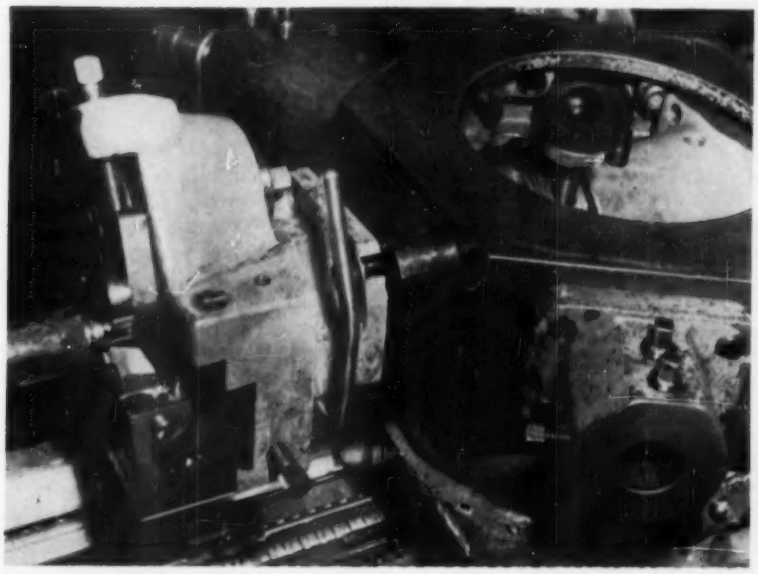
In adopting this attitude, we believe they are overlooking or attaching too little importance to the possibility that sometimes the size of a production run may grow beyond initial expectations. When this occurs, the continued use of small-lot methods tends to keep the cost up despite the volume of business which, properly studied, should permit substantial reduction in manufacturing costs of the parts being produced.

An example of precisely this sit-

points on the work. This part of the tapering function works automatically, once the setup is made.

To get the second taper, an oper-

Precision switches and dogs at rear of main turret carriage control solenoids. Engagement switch (F) operates from dogs with smaller OD than those that trip disengagement switch (G), so there is no interference between them



Chatter was eliminated at higher speed with a flanged toolholder for a center drill acting as a steadyrest

machining methods

uation was to be found in the manufacture of the Warner & Swasey Gradall roller. By analyzing the machining methods to be employed, changing the cutting tool material, and introducing a new type of tool, we were able to reduce markedly the production time required.

The original machining time, floor-to-floor, turret lathe only, for this Gradall part was 21.42 min.

The five steps taken to improve the manufacturing procedure and the resulting reductions in overall time of production follow:

1.. Changing the cutoff from turret lathe to bar stock department, which has a lower overhead, reduced the time to 17.32 min.

2.. Applying new types of carbides and increasing the spindle speed by 50% saved another 3 min, reducing the time to 14.32 min.

3.. Replacing the high-speed steel drill with a carbide gun drill brought the time down still further —to 10.99 min.

4.. Combining a chamfering operation with a pilot drill, instead of continuing it as a separate operation, cut the time to 9.6 min.

5.. Finally, by replacing a starting pilot and gun drill with a high-speed-steel drill, boring bar, and flat-tipped carbide drill, the overall machining time for the part was reduced to 8.66 min.

Because the last three steps required expensive tooling, the amortization and maintenance costs based on an assumption of 400 pieces per month had to be added to get the true cost involved. These are taken into account, together with the cost of material and of labor for turret-lathe operation, in Table I which relates the progressive reductions in overall machining time to the new—and lower—costs achieved.

As shown in Item 2 of Table I, the gain which can be made by changing to new carbides is considerable. This, of course, is accomplished largely through the increased machining speeds possible while retaining the depth of cut and feed and span of tool life normally associated with the older types of carbides.

On a few jobs, further gains were obtained through the use of the new ceramic tooling. This is particularly true of machining cold-finished parts which lend themselves to cutting with ceramics like "a duck takes to water." The scale and out-of-roundness of hot-rolled bars, on the other hand, present a problem where ceramic tooling is concerned.

An example of the former is mechanically-drawn seamless steel tubing (*AM*—Dec 3 '56, p123). Made from AISI C-1015 steel, the piece is 78.5 in. long by 4.25 in. in diameter.

Machining time was reduced from 41.35 min to 11 min flat—a saving of over 70%. This saving was accomplished by (1) replacing the standard C-5 grade of carbide with an aluminum-oxide cutter using a clamped-on toolholder having normal 5° negative rake angles, and (2) stepping up the cutting speed to 800 sfpm. The improvement in finish was obvious and at this speed there was no problem of whip to cause cutter breakdown.

CHOICE OF MATERIALS

A great deal has already been written about the benefits of free-machining steel, which could lead some to conclude that any one of

table I .. *GRADALL ROLLER COMPARISON*

		Time, minutes	Cost per piece
0.	Original method	21.42	$ 2.52
1.	Removing cutoff from turret lathe	17.32	1.94
2.	Increased speeds with new carbides	14.22	1.68
3.	New carbide gun drill	10.99	1.72
4.	Same as No. 3 but one operation combined	9.60	1.57
5.	Same as No. 4 but carbide spade drill	8.66	1.22

of carbides available, the new nickel-bonded titanium carbides, and the ceramics (Al_2O_3).

Machining methods include use of efficient and fast-cycling ma-

of material to be used.

CUTTING TOOLS AND METHODS

We have found at Warner & Swasey that a study of methods

business which, properly studied, should permit substantial reduction in manufacturing costs of the parts being produced.

An example of precisely this sit-

How to find the cheapest machining methods . . .

them is a cure-all for cost problems. This, in our experience, is not necessarily the case for each machining situation usually involves several different cost considerations.

In one study we made recently, a cross-slide screw for a Warner & Swasey 3-A machine was selected for a comparison of costs between the use of regular and of leaded steels.

The leaded steel picked for the test was A-4140, 1⅞ in. in diameter, and heat treated to 228-255 Bhn. The 150 feet of stock purchased was run on a standard Warner & Swasey 2-A machine set up with the same tooling used in regular production of this part from the standard 4140 steel ordinarily stocked.

The first turning operation on a bar 26¼ in. long was started at the 175 sfpm normally used with feeds of 0.027 ipr and depth of cut of 0.25 in.

Because of the increased machinability of the leaded material, this speed was stepped up in successive stages until chatter developed in the bar from the bar turner. To overcome this, a flanged toolholder for a center-drill tool with center removed to act as a three-roll steadyrest was added on the inside of the hex turret.

With the foregoing arrangement and using the feed and depth of cut already established, a turning speed of 300 sfpm was found to be most satisfactory with the leaded steel.

Running each material at its standard speed, namely 175 sfpm for the regular 4140 steel and 300 sfpm for the leaded 4140, it was found that the runout of the cross-slide screw did not in either case exceed 0.002 inches, nor did the taper from one end to the other go beyond 0.0003 inches.

Taking into account the increased cost of the material, the net savings obtained, as computed by our Standards Department, amounted to 0.067 hours per piece, or a total of 18% when related to the normal cycle time using the regular 4140 steel.

Basing the comparison entirely on the difference in machining time, the saving per piece was 40.2¢. Adjusting this for the greater cost of the leaded steel ($1.15 per 100 lb), the saving per piece amounted to only 3.5¢.

It was obvious from observing the cutting operation under test conditions that the leaded 4140 could be satisfactorily machined at the higher speeds with longer tool life; however, it was concluded that based on small-lot production, the addition of lead had not increased the machinability of the material sufficiently to warrant a major change in manufacturing procedure for this part.

A second study was made on the tapered roller used under the track of the Gradall earthmoving machine. This roller is made from 6¼ in. round A-4150 heat treated after machining, but before grinding, to 400 Bhn.

It was felt that if a leaded 4150 steel could be substituted for the regular 4150, and machining speed increased 50%, holding feed and depth of cut the same, it might be possible to reduce the cost of the part by perhaps 39¢.

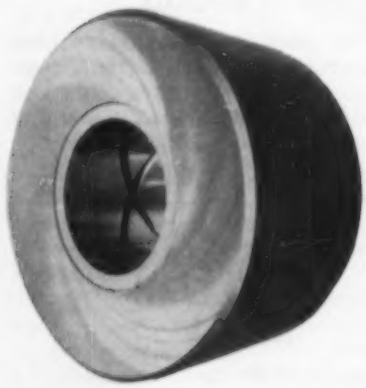
Accordingly, several mill orders were placed for leaded A-4150 steel with a 0.15 to 0.35% lead addition. Shop tests were made, running first at the standard machining speed with a regular 4150 steel, then at 25% over this speed, and finally at a 50% increase. Number of pieces per tool were recorded for the various operations of turning, drilling, rough boring, finish boring, facing, and cutoff.

When the bar was uniform in structure, all tools functioned very well and chip formation was good. When, however, the structure was erratic, very poor tool life was experienced and there was cutter breakage in hitting sections where it appeared the bar was devoid of lead.

Cost of the part was then computed, taking into consideration the material used, the machining time, and the maintenance of tools based on an assumed production of 400 pieces per month.

From Table II it will be seen that using the leaded 4150, machining at the standard speed, tool life was increased and a drop in cost of 2¢ per piece achieved.

Even though the initial cost of the material was higher, the increased tool life obtained with the leaded steel at 25% higher speeds reduced the end cost to $6.00 per piece compared with $6.25 for the standard 4150 steel. Thus, we de-



Tapered roller used in second study of leaded vs regular steel. Results of test are shown in Table II

table II . . *TAPERED ROLLER FOR GRADALL*

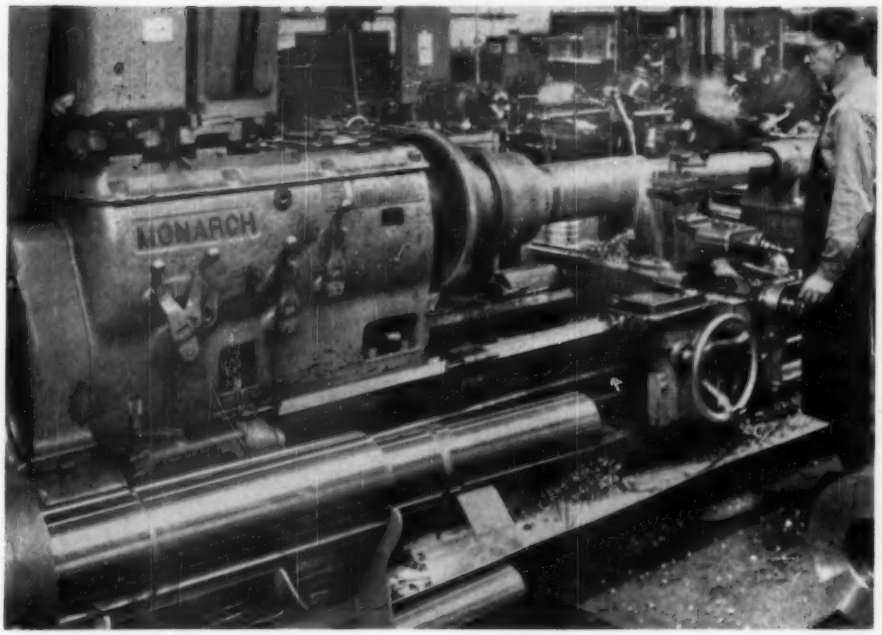
Average Number of Pieces Per Tool

	Turn	Drill	Rough Bore	Finish Bore	Face	Cutoff	Cost	4150
Leaded 4150	31	31	86	44	60	18	$6.23	Standard speed
Leaded 4150	21	24	97	34	58	10	6.00	25% over normal speed
Leaded 4150	15	23	107	53	38	6	5.99	50% over normal speed
Standard A-4150 Steel	21	42	51	33	58	13	6.25	Standard speed

3.	New carbide gun drill	10.99	1.72
4.	Same as No. 3 but one operation combined	9.60	1.57
5.	Same as No. 4 but carbide spade drill	8.66	1.22

drill with a carbide gun drill brought the time down still further —to 10.99 min.

4.. Combining a chamfering operation with a pilot drill, instead of



Desirable even though more costly was result of test on leaded steel for this forged pentagon bar

cided the use of leaded steel for this Gradall roller was justified.

A third series of tests were carried out on a leaded 1050 steel for a pentagon bar used on a Warner & Swasey 2-AC machine. Leaded steel was tried for this job, a forging, to permit study of the effect of chip control in prolonging the life of carbide tools used in trepanning operations.

With the objective an increase in machining speed of 50% so as to realize as much of a saving as possible on the cost of the material, each operation was closely checked for its contribution to the overall gain in machinability.

In some operations a steadyrest failure developed at the point of 50% increase in speed; in others, it was possible to go as high as 250% without encountering any difficulty. In every instance, the minimum gain in machinability obtained was 50% or more.

However, good as this was, the increased cost of each forging when made of a leaded 1050 steel (Table III) was such as to render uneconomic the use of the leaded material for this particular application except where, as at the present time, our plant capacity was already overtaxed.

Under the latter circumstances, the gain of 2.961 hours in machining time using the leaded steel forging has meant in effect that at an assumed rate of $20 per hour for machining time, we can, using leaded steel, purchase roughly $58 ($20 x 2.961) of sales without incurring the expense of increased factory space or additional equipment.

It would be assumed from this—and rightly so—that in such situations, plant production can be increased across the board by a small but often important percentage by obtaining additional machine time through shifting to the use of free-machining grades of steel. Even though the unit cost of the parts may rise slightly, the sales dollar income for the year can be materially improved without incurring additional capital expenditures.

This, incidentally, is one of the peculiar contributions of these free-machining materials, but it must be worked out on an individual basis with complete studies to justify each application that is considered.

table III . . *FORGED PENTAGON BAR COMPARISON*

Present machining cost for measured operations	$ 92.39
Leaded machining cost	72.52
Monetary gain in machining	$ 19.87
Present cost of forging (material)	$ 184.00
Cost of forging (leaded)	205.00
Increase in cost of forging	$ 21.00
Net increase in cost of using leaded forgings ($21 less $19.87)	$ 1.13
Hours to machine measured operations on forging of regular steel	12.229
Hours to machine measured operations on leaded forging	9.268
Saving in machine hours on leaded forging	2.961

Tapered roller used in second study of leaded vs regular steel. Results of test are shown in Table II

Standard A-4150 Steel	21	42	51	33	58	13	6.25	Standard speed

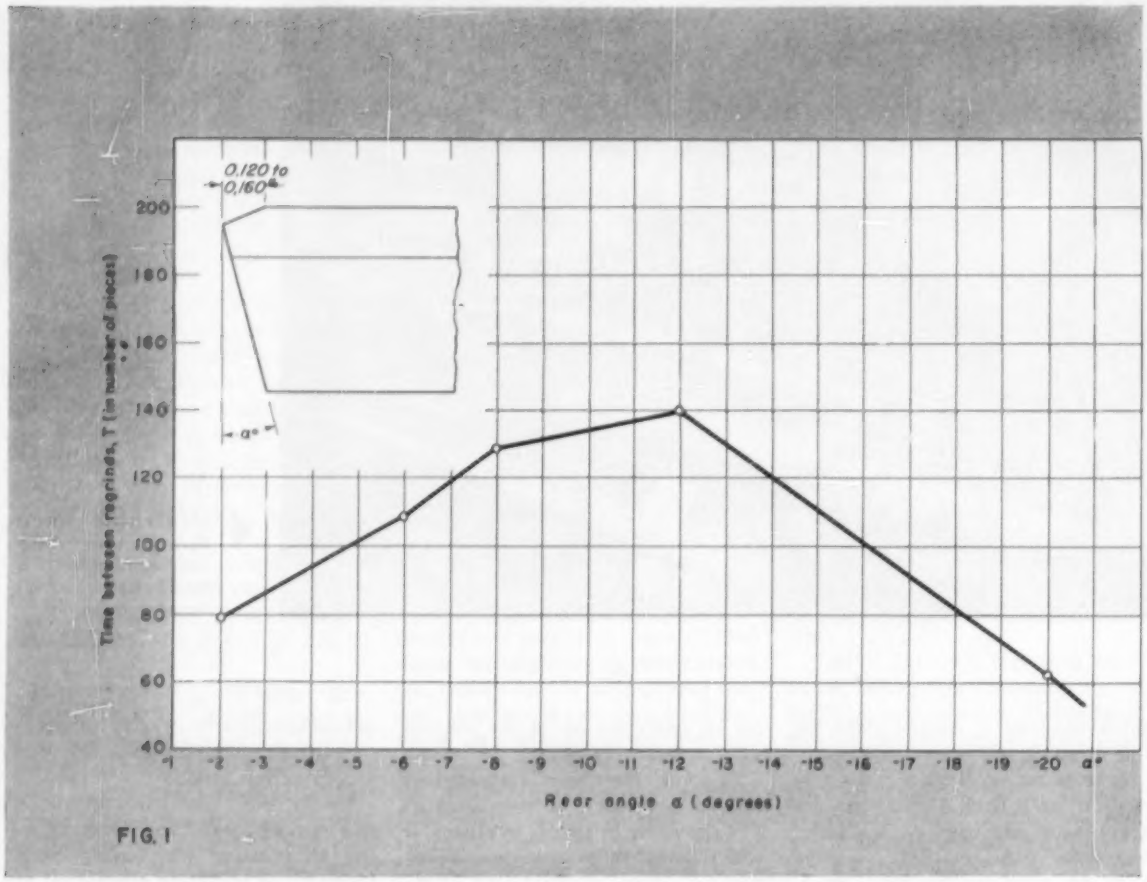


FIG. 1

High speed - heavy feed combo . . . boosts USSR output

Cutting with feeds up to ½ and ¾ inch-per-revolution, at higher than normal surface speeds, raised productivity in some shops more than 50%. And tool life was normal. The answer is in tool geometry plus vibration control.

At a research conference, held in Moscow . . . speakers described formulas which they derived for the calculation of the cutting forces, establishing a relationship between the direction of the cutting forces and the direction of the chip flow. It is possible to machine with large feeds *and* high cutting speeds, with chip cross-sections of 0.020 to 0.040 sq in., and it is possible to machine components with larger cross-sections of the cut at small cutting speeds on quietly running machine tools. Thus, more efficient utilization of the power of these machine tools is obtained. Investigations of the cutting temperature show that increase of the depth of cut and the feed have a tendency to stabilize temperature, which property opens up wide possibilities for application of this method in further increasing productivity.

Geometrical parameters of the cutting part of the tool:

It is advisable to increase the length of the side cutting edge in relation to the feeds 1.5 to 2.0 times for machining to a surface quality ▽ ▽ 5 and ▽ ▽ 6 and 1.2 to 1.5 for rough machining to a surface quality of ▽ 3 and ▽ ▽ 4.

Increase of the rear angles to 8° to 10° increases the time between regrinds 2 to 3 times compared with cutting tools with rear angles of 2° to 5°. The in-

Hours to machine measured operations on leaded forging	9.268
Saving in machine hours on leaded forging	2.961

ual basis with complete studies to justify each application that is considered.

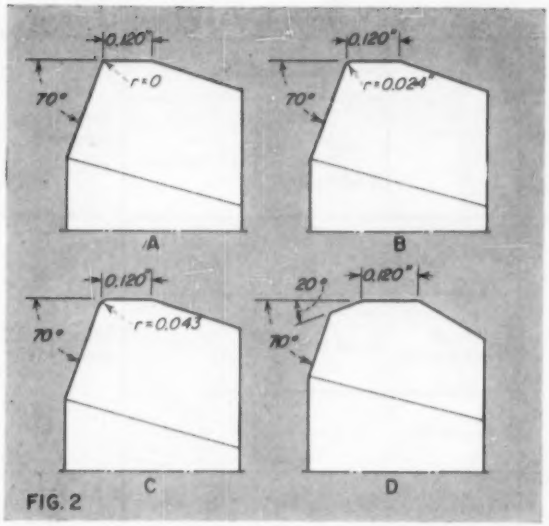


FIG. 2

fluence of the rear angle α on the time between regrinds, as determined by experiment, is shown in the graph, Fig. 1. Tests were done under the following conditions:

v = 500 sfpm, s = 0.016 ipr, t = 0.086 to 0.125 in., Machining time 0.31 min. Tool geometry: 1 = 0.070 in., $\delta f = -5°$, $\Psi = 70°$, r = 0.059 in. The tool was tipped with a sintered carbide of the composition 15% TiC, 6% Co, 79% WC.

It is advisable to connect the main and the side cutting edges by a radius and not by a rectilinear transition section. Measurement of the cutting temperature by thermocouples during cutting, with tools having various shapes of the meeting faces at the cutting edge (Fig. 2), showed that the cutting temperature is lower if this part of the cutting edge is curved (Fig 3, B and C). For a rectilinear transient cutting edge, concentration of temperature stresses occurs at the intersecting points of the transition section with the main and the side cutting edges (Fig. 3, A and D) which increases wear and decreases the time between regrinds.

Special tests revealed that cutting tools with a curved (radius) transition section (Fig. 3, C) have 30% longer life between regrinds than tools with a rectilinear transition cutting edge (Fig. 2, D). Also, cutting tools with rectilinear transition sections at the cutting edge frequently chip. The curvature radius should not exceed 0.118 in. for a substantially rigid machine tool and work combination and 0.040 to 0.060 in. for an insufficiently rigid system. Regarding the inclination angle of the side cutting edge $\lambda_0 = 0$, the inclination angle of the main cutting edge is always negative, which reduces its strength. Therefore, it is advisable to increase the angle of the main cutting edge when cutting large-cross-section chips. Surface quality is mainly determined not by the microgeometry, but by the waviness brought about by vibration, inaccuracies, displacement of the cutting tool during work and non-uni-

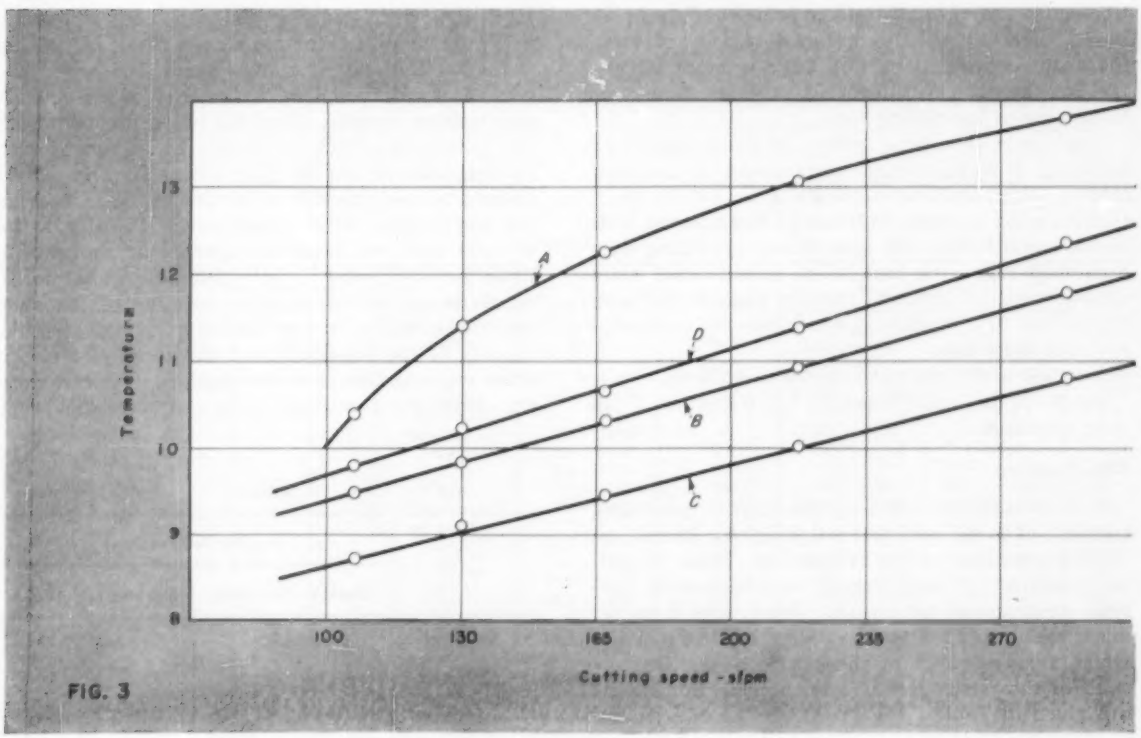


FIG. 3

obtained. Investigations of the cutting temperature show that increase of the depth of cut and the feed

time between regrinds 2 to 3 times compared with cutting tools with rear angles of 2° to 5°. The in-

High speed-heavy feed combo . . . boosts USSR output

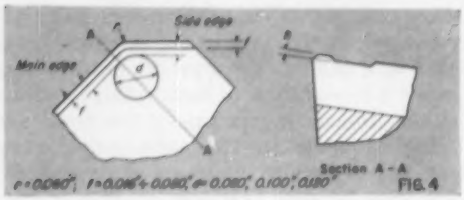


FIG. 4

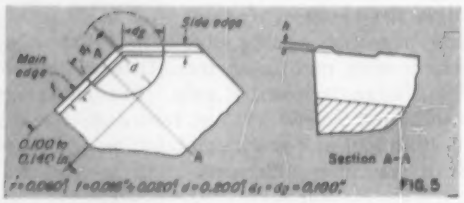


FIG. 5

TABLE 1

Groove shape	t 8 mm.	Groove dia. (in.) for s = ipr 0.028 to 0.060	Groove dia. (in.) for s > 0.060 ipr	Fields of application
Circular	0.028–0.060	0.100	0.100 to 0.140	Mass production
	From 0.060 to 0.100	0.100 to 0.140	0.140	
	over 0.100	0.140	0.140	
Sectoral. (See Fig. 5)	t > 0.028 in. s > 0.028 ipr			Individual and small lot production

form wear. The usually recommended verification of the side cutting edge with $l = 0$ with a straight-line templet does not insure a high-quality surface. The theoretical value of the waviness can be reduced by applying a curvilinear cutting edge with $\lambda_1 = 0$ and a radius of 2.75 to 6.30 in. Thus, a slight dislocation of the cutting tool during cutting will not appreciably influence the waviness. However, the relatively complicated sharpening of cutting tools with radiused cutting edges limits their application. Non-uniform wear of the side cutting edge ($\Psi_1 = 0$) lower surface quality, and from this point of view, the radius-transition cutting edge is more advantageous than the rectilinear; it provides more uniform wear of the cutting tools.

One report covered a method of finish machining applying a wide cutting tool having an inclined cutting edge (inclination angle $\lambda = 10°$ to $20°$). Cutting edges on these tools are 1.5 to 2 times as wide as the applied feed. For semi-finish machining with high feed rates, the tool is set considerably more simply because the side cutting edge is inclined, $\lambda = 15°$ to $20°$. Machining conditions recommended for such tools are:

v = 400 to 600 sfpm; t = 0.020 to 0.040 in.

s = 0.160 ipr; surface quality ▽ ▽ 6 and ▽▽▽ 7 can be obtained.

Chip breaking

It is advisable to break up the chips by providing circular (Fig. 4) and sectoral (Fig. 5) "steps" on the front surface of the carbide tip. These "steps" are produced by electro-spark machining with vertical electrodes of appropriate shape. The breakers are made only on a section of the cutting tool tip, which avoids weakening the cutting edges. Dimensions of the "steps" relative to the chip dimensions are given in Table 1.

Machine-tool rigidity and vibration: In machining with large feeds, the rigidity of the machine tools must be very high because of the very high cutting forces, which increase the ratio of the radial force P_y to the vertical force P_z, and the possibilities of vibration caused thereby. Table 2 contains some data on the rigidity of some Soviet machine tools for $P_z:P_y:P_x = 1.0 : 0.35 : 0.15$ for a total cutting force of P = 2200 lb. Rigidity of the slide (tool) rest depends to a considerable extent upon the ratio $P_z:P_y:P_x$; with decreasing $P_y:P_z$ and increasing $P_x:P_z$ the rigidity is increased as a result of turning in the vertical and horizontal planes. For large relative values of P_z and P_x the rigidity of a slide rest may become negative. Dynamic investigation carried out by turning eccentric and stepped specimens with cutting tools having the side cutting edge ($\Psi_1 = 0$) showed no reproduction of errors in the surface on the component. With increasing depths of cut, the vertical and the axial components of the cutting force increase more rapidly than the radial force, which brings about negative rigidity of the slide rest overshadowing the influence of the positive rigidity of the headstock and tailstock. Absence of error reproduction from the machine-tool system to the machined component is a characteristic prop-

TABLE 2

	Rigidity (inch-pounds)	
	Machine Tool 1A62	Machine Tool 1D63A
Headstock	265,650	343,750
Tool Rest	399,300	383,350
Tailstock	408,100	334,400

FIG. 3 Cutting speed - sfpm

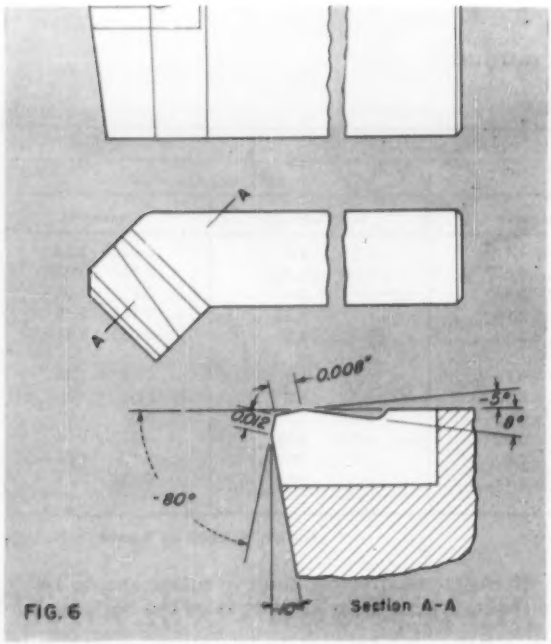


FIG. 6

erty of machining with large feeds, and this phenomenon requires further investigation.

In machining with large feeds, the tool vibrates at a high frequency and the machined components with a low frequency. Rizhkov developed an effective and simple method of quenching these vibrations.

The cutting tool developed by him (Fig. 6) incorporates an anti-chatter face especially designed for machining with large feeds. The vibration quenching (anti-chatter) face can be preliminarily produced on a lapping machine or by hand with a whetstone or a cast-iron plate coated with boron-carbide paste. When lapping by hand, use an attachment which will insure producing the required angle.

Another scientist proved the possibility of machining with feeds of 0.40 to 0.60 ipr of the blank (instead of the usually applied feed of 0.040 to 0.060 in.) on gear milling machines by using parabola-shaped milling tools. He also found that the strength of drills permits operation with feeds 50% to 100% higher than the usual recommended values.

To assure satisfactory operation with high cutting speeds and large feeds, it is necessary to have a suitable range of machine tools. The Soviet machine-tool industry is *preparing to produce* new lathes (Table 3), milling machines, drilling and boring machines, and other high-productivity machine tools. Also, some of the existing machine tools can be easily rebuilt to operate with large feeds. In lathes, the peripheral speed of the gears limits increase in feed. Guiding data for modernization of some current Soviet lathes for operation with large feeds are given in Table 4. *To improve the operating characteristics of machine tools, measures must be adopted to reduce vibration and to increase the power of the drives.*

Shop experience:

Machining with large feeds is used for about 140 different operations in the "Red Proletarian" Works; by introducing better tool geometry, the average feed was increased from 0.016 to 0.045 ipr, thereby reducing the average machining time by 61%. In the Stalin Automobile Works, large feeds are used for both turning and milling; for face milling of steel and cast-iron, milling cutters with tooth-face cutting edges having a plan angle $\Psi_1 = 0$. Such milling tools permit application of feeds up to 12 ipm for steel and up to 40 ipm for cast-iron. Large feeds (up to 0.020 in.) are also applied in broaching machines, reducing both the length of the broaches and the broaching time.

In locomotive work, machining with large feeds is applied in 161 operations. For machining large components, the feed is up to 0.160 to 0.200 ipr, maintaining the original depth and speed of cutting, thereby reducing the machining time to one half or one third. High-speed machining with large feeds is also applied to planers. For example, in machining

TABLE 3

Machine Model	Max. dia of machine component (in.)	Maximum distance between centers (inches)	Number of spindle speeds	Speed limits of spindles (rpm)	Number of feeds	Feed range (ipr)		Power (kW.)
						longitudinal	transverse	
1602	5.2	10	Steplessly adjustable	120 – 2860	5	0.001 – .008	Manual	0.4
1610	8	14	adjustable	50 – 2010	8	0.001 – .020	Manual	1.7
1613D	10	10.5	24	65 – 2000	10	0.002 – .100	Manual	1.0
1616	12.8	30	12	44 – 1980	14	0.002 – .350	0.001 – .100	4.5
1A62	16	30; 60	24	11.5 – 1200	35	0.0025 – .060	0.001 – .020	8
1620	16	40	Steplessly adjustable	18 – 3000	—	0.002 – .040	0.0008 – .020	13
1P625	20	40	18	31.5 – 1600	32	0.002 – .050	0.001 – .027	14
163	25	60; 120	22	10 – 1250	32	0.004 – .079	0.001 – .028	14
1D63M	25	60; 120	21	9.9 – 1000	32	0.004 – .060	0.001 – .020	14
164	32	120	24	7.5 – 750	40	0.005 – .160	0.002 – .063	22
165	40	120	24	5 – 500	32	0.008 – .122	0.002 – .020	28
1660	52	260	Steplessly adjustable	3.15 – 200	16	0.008 – .450	0.0025 – .180	60
1670	64	320	adjustable	2.5 – 160	16	0.005 – 1.8	0.002 – .360	100
1680	80	400	adjustable	2 – 180	16	0.005 – 1.8	0.002 – .360	120
1682	120	1264	adjustable	0.51 – 58	8	0.010 – 0.8	0.002 – .200	260

sions of the "steps" relative to the chip dimensions are given in Table 1.

Tailstock	408,100	334,400

High speed-heavy feed combo . . . boosts USSR output

TABLE 4

Machine Model	Number of feeds	Feed (mm/rev)			
		Before modernization		After modernization	
		longitudinal	transverse	longitudinal	transverse
1615	90	0.06 – 2.72	0.025 – 1.1	0.06 – 4.0	0.025 – 1.62
1625P	42	0.06 – 2.12	0.018 – 0.627	0.09 – 3.22	0.027 – 0.955
1617	48	0.12 – 3.1	0.057 – 1.46	0.16 – 4.4	0.81 – 2.08
1618	48	0.055 – 3.35	0.05 – 2.98	0.071 – 4.35	0.065 – 0.88
161, 161A 161AM	56	0.062 – 3.55	0.052 – 2.92	0.062 – 4.2	0.052 – 3.64
1D62	26	0.12 – 2.15	0.04 – 0.72	0.12 – 4.3	0.04 – 1.44
1D63	26	0.15 – 2.65	0.05 – 0.90	0.15 – 5.3	0.05 – 1.8
1D64	24	0.225 – 3.15	0.07 – 0.95	0.025 – 6.3	0.07 – 1.9
1D62M	35	0.08 – 1.59	0.027 – 0.522	0.082 – 3.18	0.027 – 1.04
1A62	35	0.082 – 1.59	0.027 – 0.522	0.080 – 3.18	0.027 – 1.04
162, 162K 26A	48	0.07 – 4.18	0.038 – 2.26	0.07 – 4.18	0.038 – 2.26

For ipr, multiply by 0.0394

locomotive frames, feeds of s = 0.500 in. per table stroke (double stroke) are applied instead of s = 0.080 in.; in finish planing s = 0.600 in. is applied instead of s = 0.120 in., with original cut depth.

In the bearing industry 420 machine tools were changed over to work with large feeds. On some of the semi-automatics, feeds were increased by 25% to 50%, thereby increasing productivity 15% to 20%.

Face milling with large feeds: For reducing the impact of the milling-cutter teeth on the work during engagement, it is advisable to increase the angle E of engagement of the milling cutter and to reduce displacement of the generatrix of the milling cutter relative to the plane A of the machine component to a value C (Fig. 7), whereby C = (0.03 to 0.05) D, D being the milling cutter diameter in inches. ENIMS (AM—Dec 17 '56, p116) recommends the cutting portion of the milling-tool teeth having a side-cutting edge as shown in Fig. 8. A milling-tool operator of "Stankokonstruktsiya" applied this method for milling steel and increased the feed 6 to 8 times the recommended value. In machining forgings made of 4½-in.-wide "Steel 45", he applied a feed s_z = 0.031 to 0.055 in. per tooth, t = 0.080 to 0.160 in. and v = 300 to 350 sfpm; the milling cutters were 7 and 8 in. in dia. with 4 and 8 teeth respectively and the geometrical shape of the cutting section of these is shown in Fig. 8. The value of C was 0.32 to 0.40 in., corresponding to E = 1.75 to 2.15 in. With these machining conditions the milling tools had normal wear and no tooth chipping.

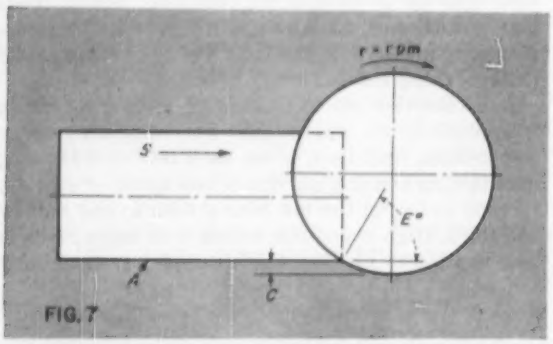


FIG. 7

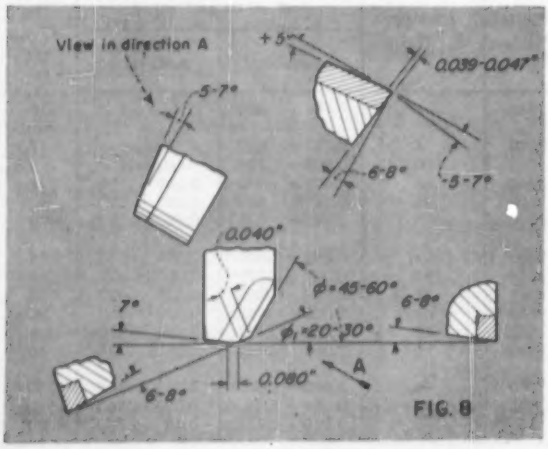


FIG. 8

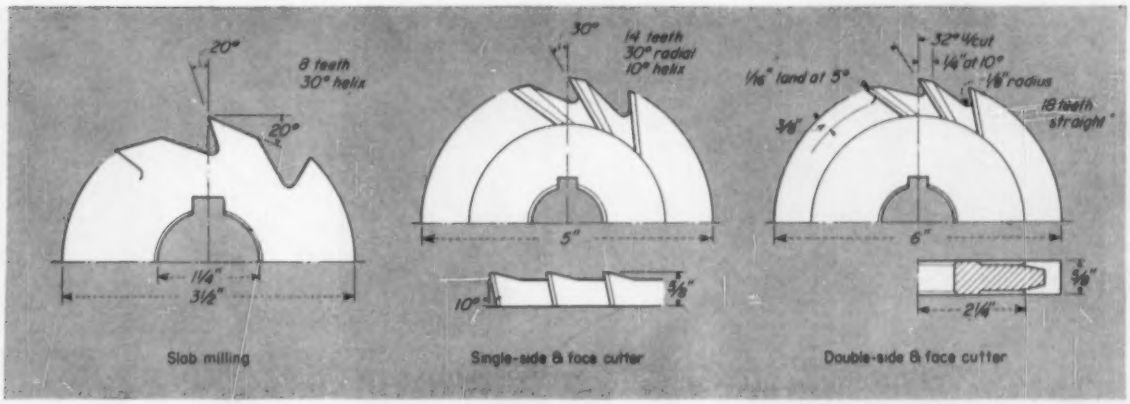
Heavy-engineering shops, working with large chip cross-sections should use feed values in Table 5. For a time-between-regrinds of 90 minutes, cutting speeds for the depth of cut and the feed values given in Table 5 should be calculated according to:

$$v_{90} = \frac{98.6}{t^{0.11}\ s^{0.46}} \quad \text{(m/min.)}$$

TABLE 5

t (inch)	Feed(s) in ipr		
	Machining of steel of b = 82,500 psi	Machining of steel of b = 110,000 psi	Machining of steel of b = 110,000 psi
Up to .240	.080–.100	.072–.084	.064–.076
0.240–0.400	.072–.084	.064–.072	.052–.060
0.400–0.600	.064–.072	.056–.060	.048–.056
0.600–0.800	.056–.064	.048–.056	.040–.048
0.800	.048–.056	.040–.048	.032–.040

1682	120	1264	adjustable	0.51 – 58	8	0.010 – 0.8	0.002 – .200	260



High-rake cutters triple life and speed on high-tensile steels

English tests show results reported several years ago in US tests on high-rake milling of ordinary steels can be obtained on high-tensile aircraft steels as well. Here is a summary by Peter Trippe of our London office

Cutter life and speed can be multiplied by three with high-rake cutters, when high-tensile steels are cut, according to recent tests by the Development Engrg Dept, Brooke Tool Mfg Co, Ltd (England). Power consumption is cut and the same cutter can be used for roughing and finishing. Best conditions for high-rake slab milling were obtained with an 8-tooth, 3½-in.-dia cutter having 20° radial rake and 30° helix. Die steel of 217 Bhn was milled at 280 sfpm.

Tests were on En 24 (C 0.36%, Mn 0.75%, Ni 1.7%; Cr 1.05%, Mo 0.39%, S 0.011%, P 0.043%, Si 0.14%, V-trace), hardened to 60-64 tons (125,000 psi) tensile. Cutters were 18-4-1 HSS at 63-64 R_c, 3½-in. dia, 2 in. wide, with 10 to 30° radial rake, 20 to 40° helix, 5° peripheral relief, 8 to 10 teeth. Cylindrical cutters for slab milling, slotting cutters, and a variety of side-and-face cutters were tested.

Soluble oil (32:1) directed at the back of the cutter, with tooth loading at 0.0048 ipt, gave metal removals of 28 to 47.1 cu in., much lower than anticipated. Study showed that coolant was not passing along the whole of the cutting edge because of the high rake. Coolant was then directed at the front of the cutter, so the cutter was covered before striking the work; this gave metal-removal rates of 50.6 to 108.6 cu in., with loading of 0.005 ipt. Wear on the periphery was only 0.020 in.—130% better than with the coolant from the back. A conventional cutter of 10° radial rake and 35° helix gave only 63.3 cu in.

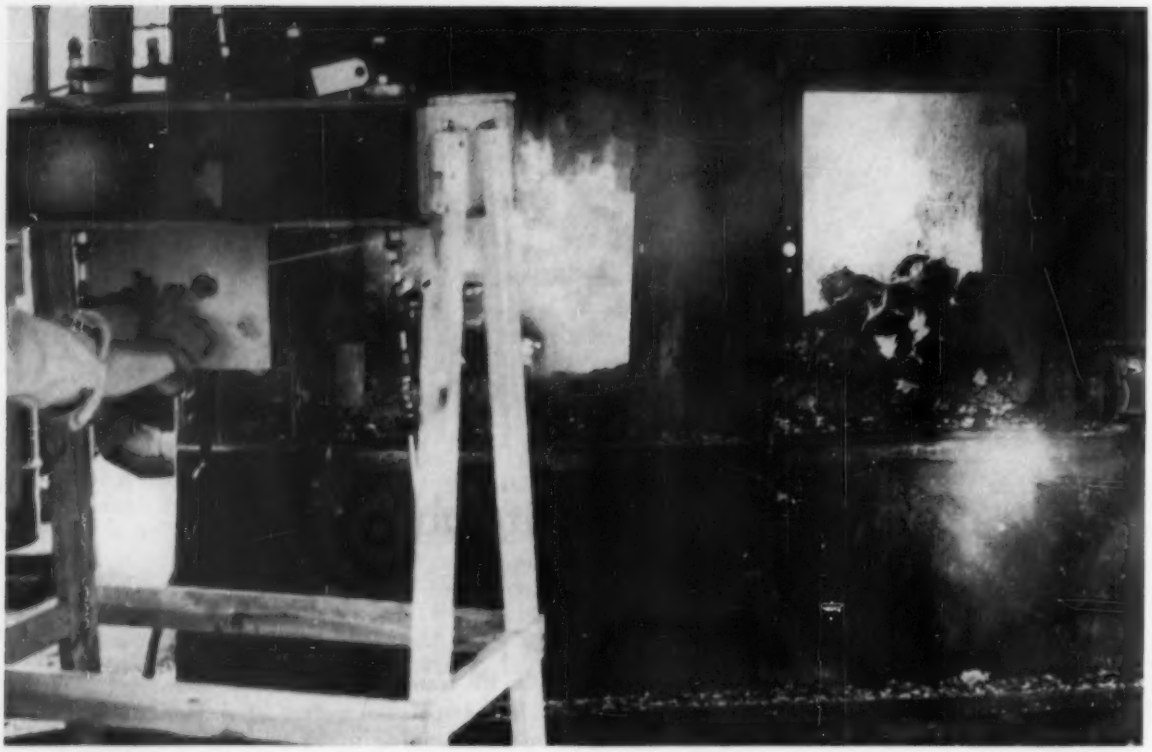
When speed was raised to 165 sfpm, efficiency dropped to about half the best volume (54.3 cu in.), indicating that 130 sfpm is best for the 125,000-psi material cut.

Power consumption was markedly reduced with the 20° radial rake, 30° helix cutter as well. It required only 2.4 hp per cu in. of metal removed, while a conventional cutter required 4.6 hp. Thus power consumption could be cut 48%. Other factors worth mention included high finish on ground surfaces, with a hand-honed 45° land 0.002 to 0.003 in. wide on the cutting edge to avoid crumbling (like technique for carbides). The machine must be absolutely rigid, suitable for down-cut milling, and the cutter must run true to the table.

Single-sided side and face cutters were tested similarly by down milling. Best results were obtained with a cutter having 30° radial angle and 10° helix, 5-in. dia, ⅜ in. thick, and with 14 teeth. Tooth loading of 0.005 in. showed no advantage for the high-rake tool over a conventional 10° cutter. But when tooth loading was made 0.006 ipt, the high-rake designs showed an average increase of 230% metal removal.

Side-and-face cutters, with straight teeth (no helix and no stagger) were developed for cutting on both sides, and showed excellent results. These cutters are 6 in. in diameter, have 32° radial rake and 18 teeth. Surprisingly, such a cutter is about as good as a spiral-tooth cutter and much easier to grind.

Currently, tests are being made in 70-75 ton range (150,000 psi steels). A current question is where a shift should be made to splined arbors for rigid power transfer.



SYNTHETIC FLUID BEING SPRAYED . . .
directly into open furnace at 100 psi burns inside furnace, but jet does not, nor does flame travel back to nozzle

Fire-resistant hydraulic fluids can save $1 million/year

CHARLES EMERSON, associate editor

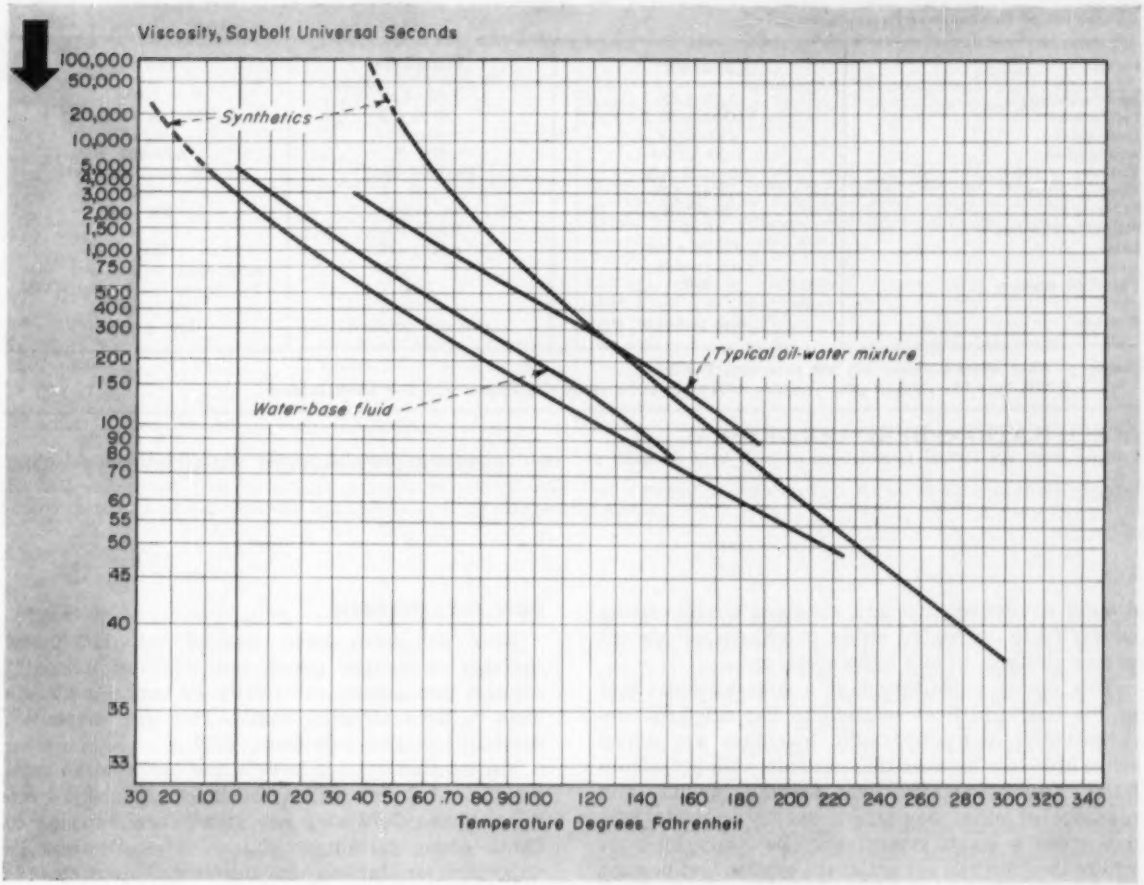
. . . because that's what industrial fires involving hydraulic fluids cost. They range from minor $1500 blazes to a single $675,000 catastrophe, but all are dangerous to human life. Costs for fire-resistant fluids are higher than regular petroleum fluids, but because of the expense, better maintenance can reduce costs throughout the hydraulic system

Insurance-company records show just how and why hydraulic fires start. Five years of oil-fire history, covered by one insurance company, proves that fires usually start when petroleum hydraulic fluid gets to these sources of ignition:

- Molten metal—in die-casting equipment
- Hot metal surfaces—heaters, furnaces
- Open flames—torches
- Welding sparks—arc and spot welders
- Electrical equipment—shorts, arcing contacts

In most cases, the fire starts when a hydraulic line fails under pressure and the fluid runs or sprays to the source of ignition. In few cases do fires involve pools of oil on the floor. This point has some importance, because it demonstrates that distance between the hydraulic system and a possible source of ignition is not necessarily a good-enough safety factor. Fires have started as far away from hydraulic systems as 40 ft because the fluid spanned that distance when released. In most hydraulic systems the fluid is under high pressure, and even a small leak can spray liquid a considerable distance.

An interesting sidelight on these insurance records is that in not a single case where overhead sprinklers went into action was there a steam explosion as water hit molten metal. Water isn't theoretically the best material for blanketing oil fires, but it is often effective. Losses average nine times as high in unsprinklered areas as in those guarded



VISCOSITIES OF TWO TYPICAL SYNTHETIC FLUIDS . . .
a water-base fluid, and an emulsion follow similar curves as plotted against temperature. Major difference is that synthetics can be tailored to higher or lower ranges, depending on ultimate use

by sprinklers. It usually takes large quantities of CO_2, foam, or dry powder to put out the same kinds of fire that water will control—one case required two tons of CO_2.

Overhead sprinklers are a big factor in setting industrial-insurance rates, but insurers do not usually charge a higher rate where ordinary petroleum hydraulic fluids are installed. Therefore, there can be no savings on insurance rates when fire-resistant fluids are installed. However, there is a current trend (among mutual insurance companies) to refuse coverage in some cases if the hydraulic fluid is not fire resistant.

The major economic advantage for fire-resistant fluids is simply in preventing fires. One fire less in a given plant will pay for a large quantity of hydraulic fluid.

THREE KINDS

Ordinary petroleum hydraulic fluid will ignite if it's dropped on a metal surface heated to around 700 F (autoignition point). Fire-resistant fluids are not actually fireproof—all of them will eventually flame if exposed to temperatures high enough. But their autoignition points are high enough to make them quite safe under practically any industrial conditions.

Some attempts to add "snuffing" agents to normal petroleum fluids have been made, but so far nothing successful has resulted. One alternate solution to the fire problem is to use water as the hydraulic fluid. This has been successful in a number of special machines; aluminum extruding presses, baling presses, some steel-mill equipment, and some forging presses. The problem here is that even if a soluble oil is added to the water, any lubricating value is quite low. Proper lubrication can only be applied in a separate system, which is entirely possible in new designs of equipment. With water as the hydraulic fluid, packings must be water resistant and bearings must be sealed off. From 1 to 2% soluble oil in the power circuit will help cut corrosion inside the system.

This is no solution for the mass of existing hy-

Fire-resistant hydraulic fluids can save $1 million/year

Comparison of Fire-Resistant Hydraulic Fluids

Factor	Synthetic	Water-base	Emulsion
Specific Gravity	1.13–1.25	1.05—1.10	0.93
Pour point	–30 to +30 F	–70 to 0 F	Not for use below 32 F
Flash point	430–500 F	none[1]	none[2]
Autoignition	1100–1200 F	900 F	800–900 F
Viscosity @ 100 F	80–1000 SUS	80–1000 SUS	450 SUS (approx)
Viscosity index	–30 to +30	140	140
Solvency	to paints	to paints	like oil
Neutralization No.	0.05	9.5-10 (Ph)	
Seals	attacks most	mostly OK	like oil
Lines	no trouble	no trouble	may need larger inlet lines
Cost X oil cost	5–7	3–4	2–3 (water-in-oil) slightly + (oil-in-water)
Best use	high pressure	medium pressure	low pressure

Notes: 1 After water is driven off, will burn with low flame
2 Will burn like pure oil after water is driven off; burns to varying degree with low water content

SPECIFICATIONS HERE ARE GENERAL . . .

because there are several formulations of each kind of fluid, and such properties as viscosity, specific gravity, and flash point vary

draulic equipment, nor are standard circuits being converted to use water, either in present equipment or new designs, to any known extent.

This leaves substitution of a fire-resistant fluid as the only practical solution to the fire problem. Admittedly, many hydraulic machines are in no sense fire risks because they operate with petroleum fluid. Equipment location, system layout, and presence of other equipment nearby indicate how dangerous a given system may be. Only in cases where the fluid can get out of the system and become ignited by existing equipment in the neighborhood should fire-resistant fluids become necessary.

There are three general types of fire-resistant fluid presently available:

* Synthetic—also called "non-aqueous", a chemical compound that may be a phosphate ester, a chlorinated hydrocarbon, or some similar mixture of chemical compounds. These fluids have the highest autoignition points, good lubricating qualities, stability in the system, and they work well in systems with up to around 5000 psi.

* Water-base—a fluid made up with water, glycol or polyglycol, a thickening agent, and rust and wear inhibitors. These are less expensive than the synthetics, and can be operated in medium-pressure systems, from 500 to 2500 psi, or so.

* Emulsion—a mixture of petroleum oil and water in one of two ways: Oil-in-water emulsions are similar to cutting fluids, but with a higher proportion of oil. Viscosity is constant, regardless of the oil-water ratio, and water losses from evaporation can easily be made up by adding water to the system. Water-in-oil emulsions must be mixed under controlled conditions, normally by the supplier, but viscosity can be varied by adjusting the water-oil ratio. Cost for water-in-oil is low, but still more than petroleum fluid. Oil-in-water is only slightly more costly than petroleum fluid.

HOW THEY PERFORM

They will burn when sprayed onto hot metal surfaces or molten metal, but will not normally support combustion sufficiently to carry the flame back to the hydraulic system. They are much less combustible than petroleum fluid.

The synthetic fluids have a low evaporation rate, which contributes to fire resistance. Actually, even a petroleum fluid may not burn when exposed to flame under certain conditions. The oil must be vaporized or broken up into small particles to burn freely—as in a spray. If the ignition source is not extremely hot, a pool of oil will not usually burn. In some cases, petroleum fires have been stopped by agitating the liquid (in a tank) with air blown into the tank. This circulates the fluid, bringing cooler oil to the top surface, which quenches the fire. A solid stream of petroleum oil is not particularly combustible, but as soon as the stream starts to break up, watch out!

Anti-wear properties of the synthetic fluids are high. In one laboratory test, a synthetic fluid actually performed better under concentrated (anti-friction) bearing load than petroleum fluid, but other tests have indicated different results. General opinion seems to be that in field service the synthetics allow anything from 70 to 100% of the bearing life expected from petroleum oil, depending on load conditions.

These fluids are less compressible than petroleum oil by a slight margin, and make good power fluids for hydraulic systems. Toxicity is no more a problem with them than it is with common oil—with either, conditions of high temperature and long exposure may be dangerous, but this factor is of little importance in hydraulic systems.

Water-base fluids have advantages in lower cost and high viscosity index. The proportion of water in the mixture should be roughly maintained for

Packings & Lines for Fire-Resistant Hydraulic Fluids

	Synthetic	Water-base	Emulsion
Packings:	Butyl Silicon Nylon Teflon	Standard oil seals; but not cork-impregnated rubber in dynamic seals	No change from oil
Filters:	Standard oil types	Screens of nickel, brass, copper; or cotton waste. Cellulose swells. Don't use cadmium- or zinc-plates screens nor earth filters	Edge-plate or knife-edge types; Metal screens of 4X normal mesh. Don't use earth, cotton, cellulose
Greases:		Lithium, calcium, aluminum soap bases; don't use sodium-soap grease	Water-resistant greases only
Paints:	Use special paints, or none	Use special paints, or none	Oil-resistant paints OK
Special notes:	Absorbed oil increases fire danger—don't allow over 5%	Check inhibitors against vapor-phase corrosion; add when necessary	Check oil-water ratio by testing viscosity

THESE ARE ROUGH RECOMMENDATIONS . . .
for fluid installations, intended only as guides to the problem each fluid brings up. Manufacturers of fluids can all supply more detailed recommendations, usually with case histories to back up maintenance advice

several reasons: fire safety and viscosity are the most important, and are tied together somewhat. If the water should separate out inside the hydraulic system, there would be more fire danger. However, long before this got to a critical point the change in viscosity would be noticed, either through regular inspection and test or because of a change in machine operation.

Vapor-phase corrosion has been a problem with the water-base materials, but inhibitors are included in the fluids to control this effect.

Emulsions of water in oil, and of oil in water, are fairly compatible with existing hydraulic circuits designed for petroleum products. One exception is that seals should be water resistant. These mixtures will not harm paints inside hydraulic systems.

WHAT'S WRONG WITH THEM?

Fire-resistant fluids are not generally ideal substitutes for petroleum oil, although in many cases the synthetics have provided bearing life approaching that with petroleum. Water-base fluids do not provide as much freedom from bearing wear as the synthetics, but they are usually applied for lighter duty. The emulsions, also, are for lighter duty.

Synthetic fluids attack many of the sealing materials common to oil systems to some extent, causing them to swell. As far as static seals are concerned, this simply tightens them up and prevents leaks in the system. Dynamic seals may tighten up to the point where they may wear metal, or slow down the system, so they should be changed when the new fluid is inserted (see table of sealing materials). Sometimes even these have been left in the system until the next regular seal inspection without ill effect.

One other danger with synthetic fluids is oil left in the system when it is converted. Oil is absorbed by the synthetics, and it cannot be removed. A small quantity—around 5%—is acceptable, but more starts to reduce the fire safety of the liquid. For this reason, best practice is to clean the system well when changing over, and to make sure new oil cannot get into the lines.

If seals cause the most trouble, then cost is the major objection to the synthetic fluids. But there have been rough records kept on some installations to show that the total extra cost was much lower than would be indicated by the high cost per barrel alone. This may come about because of several reasons:

* High fluid cost makes the user sensitive to waste—at least it should, so maintenance practices are tightened up and more attention is given to the hydraulic system.

* Better couplings, joints, packings, and fittings may be installed, which reduces waste.

* Filtration may be done more frequently to keep the material cleaner and running better.

These effects can possibly cut fluid losses as much as 90%, and have done so in some plants. This may cut the extra cost of the synthetic material to only 3 times (or some similar figure) as much as petroleum.

On the other hand, the same rules apply, not only to the other fire-resistant materials, but to petroleum itself. Better maintenance of hydraulic systems can always reduce liquid losses; but the expense factor in fire-resistant materials makes the point more obvious.

Water-base fluids do not attack seals to any great extent, but they do attack paint—to a slightly lesser degree than the synthetics. Cleaning the system before conversion is necessary, as it is with synthetics. Water-base materials operate if petroleum is left in the system, but remaining oil presents a

fire hazard and should be removed. Oil will float in a system using either a synthetic or water-base fluid, and may accumulate in a high point. If a break should occur there, fire danger could be critical, even though a fire resistant fluid filled most of the remainder of the system.

Water-base materials help resist wear in vane pumps with sleeve bearings as well as the synthetics, or as well as petroleum fluid. In anti-friction bearings, they may allow more wear than the synthetics, which in turn allow more wear (usually) than petroleum. Vapor-phase corrosion may become a disadvantage with water-base materials in some cases; however, industrial service reports have shown this to be a minor factor.

Water-base fluids will operate at temperatures well below zero, but 150 F is a top limit because of water evaporation. Actually, reservoirs should be kept at a lower temperature than this, simply as a matter of good hydraulic practice, no matter which fluid is being used. These materials (water-base) operate satisfactorily in medium-duty applications, under a top pressure of 2000 psi for continuous service.

Emulsions, too, should not be operated at over 150 F. Line capacity on the inlet side may be a problem, and inlet screens should be changed to provide larger openings—two, three, or perhaps even four times as large as usual. Cavitation may result if flow is restricted.

Emulsions work well in light-duty systems, and have reasonably good lubricating qualities and operate with efficiency. They should be kept away from hot magnesium, and electrical solenoids inside the system should be removed. Separation is a problem with some of the emulsions—and this can happen over a weekend or even overnight. Continuous circulation may be the answer to this problem.

CONVERTING FROM OIL

When installing fire-resistant fluid, procedures vary somewhat depending on the fluid to be used.

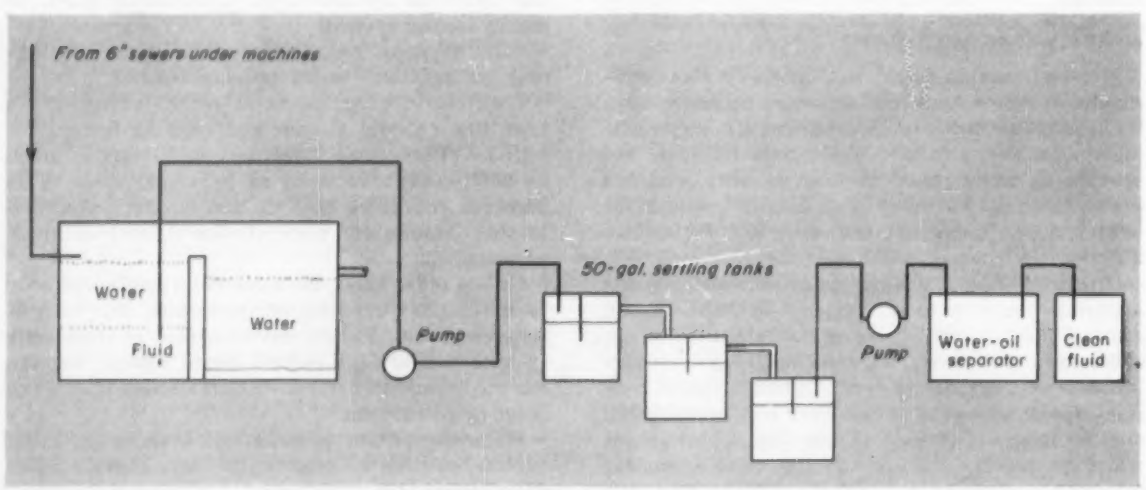
For the synthetics:
- Remove paint, drain oil
- Clean or replace filter
- Change dynamic seals, bladders, and worn hoses to compatible materials

For water-base fluids:
- Remove paint, drain
- Replace galvanized or cadmium screens with nickel or brass
- Check pipe-joint compounds and replace if necessary

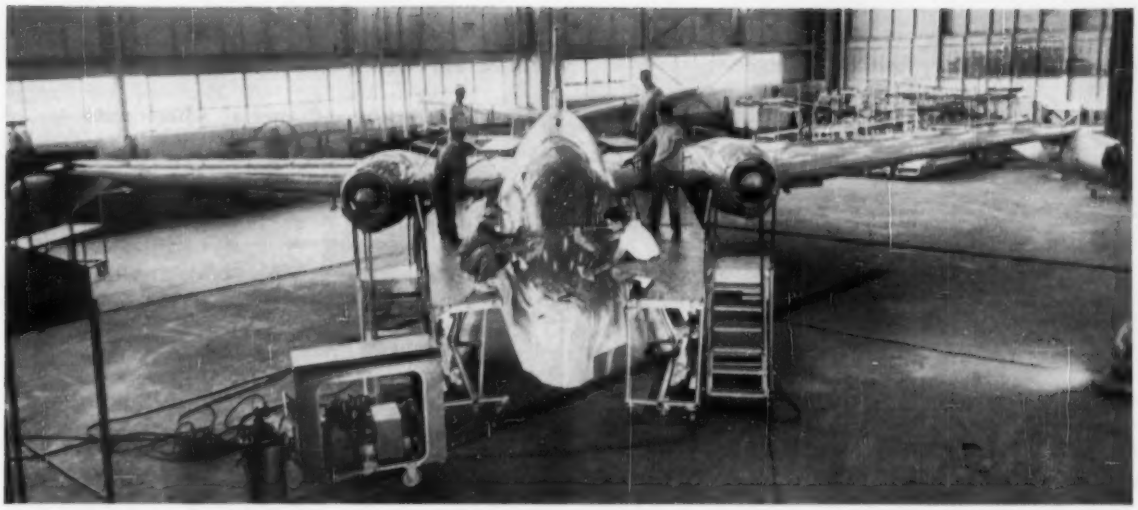
For emulsions:
- Drain oil
- Clean, check filters at intervals
- Enlarge inlet system & screens if necessary
- Possibly set up for slightly reduced flow

We would like to extend our sincere thanks to the following organizations for their help in providing material for this article:

Carbide & Carbon Chemicals Co
Celanese Corp of America
Factory Insurance Assn
E F Houghton & Co
Monsanto Chemical Co
National Conference on Industrial Hydraulics
National Fluid Power Assn
Shell Oil Co
Socony Mobil Oil Co .
The Texas Company



SYNTHETIC FLUIDS CAN BE RECLAIMED . . .
which cuts down their cost by a large margin. This system uses settling tanks, but fluid may also be centrifuged for speed. Portable filter should be used at least temporarily after system is changed over to a synthetic



Two coats instead of three . . .

complete the job with this airless paint spray which has been adapted to painting aircraft. First successful adaptation of airless paint spraying to aircraft, this virtually fogless technique has many advantages over conventional air-spray methods. In addition to the elimination of one coat of paint, less masking is required on adjacent surfaces. It is possible to spray without an operator's face mask, and field reports stress that paint applied by this new process is more durable. (see cover)

Airless paint spraying for production

SAVES . . PAINT . . LABOR . . SPACE . . TIME

WILLIAM BRESNICK, senior manufacturing engineer
Manufacturing Engineer and Research, THE MARTIN COMPANY, BALTIMORE

Martin is the first airplane manufacturer to paint aircraft with the airless paint-spray process. This airless, and relatively fogless, unit employs a new concept of atomizing paint for spray application.

The airless paint-spray unit, made by the Bede Products Corporation, has been adapted for painting aircraft after intensive research by Martin engineers. Its many distinct advantages prove it far superior to older methods of paint application.

Today, with this new method it is possible to paint the Martin USAF B57 jet bomber with two coats af paint and get a high-gloss finish with the same film thickness as was formerly obtained with three coats. This change not only affects a one-third saving in labor but also a 30 to 40% saving in paint because the fog, with its attendant waste of paint natural to all air-fed-spray units, is virually eliminated as no air is mixed with the paint when it leaves the nozzle. In fact, the spray is so fine and limited in fog displacement that it is not necessary to completely mask off all adjacent surfaces.

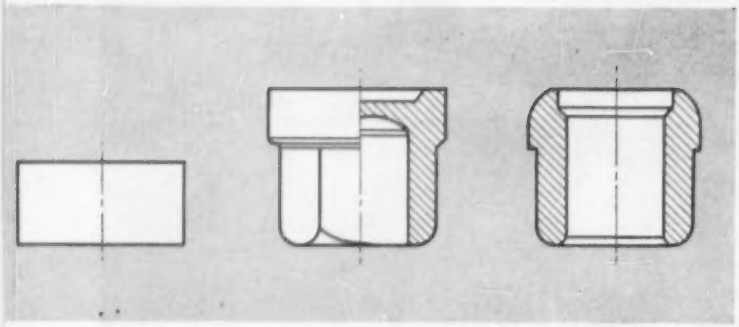
Airless equipment also can be used outdoors if necessary. Although the personnel engaged in painting wear face masks as a health and safety precaution, it is possible for operators to spray paint comfortably with the new method without wearing masks and suffer no ill effects (see cover).

Thus, it is possible and convenient to use the new spray in closed areas where regular equipment could not be used. Field reports from service aircraft facilities stress the increased durability of aircraft paint applied by the new airless unit.

Paint is drawn from a standard container, heated to 160 F, and hydraulically pressurized to 600 psi. Solvents, under heat and pressure, atomize the paint at the spray nozzle, applying more paint solids to the surface being sprayed than with other methods. Heated paint is kept circulating throughout the paint equipment, at all times, by a pump. Continuous circulation prevents the paint from settling or hardening in any part of the system.

This new technique in paint spraying came as a successful conclusion to a long project of research and experimental study by the Manufacturing Research and Development Laboratory, working in close cooperation with the Engineering Laboratory. The engineering group spent many hours developing the correct paint mixtures which would be suitable with the new system. Operators who maintain the equipment and apply the paint also were especially trained for the process.

Development and adaptation of the airless paint spray for applying the finish coats to aircraft was thought to be impossible several months ago. However, with excellent results in evidence, backed by favorable field reports, the new painting technique promises to supplant the former conventional paint-spray methods.



Production of special wheel nuts by extrusion involves cutting-off an accurate slug, extruding the hex and piercing most of the way through from both ends, and finally turning the spherical surface, drilling or piercing the diaphragm or web left after extrusion, and cutting the thread. Total savings on labor and material over original method—50%

Cold extrusion of special nuts cuts costs 50%

OLAF STEPANEK *

Tatra makes hex nuts in several sizes by cold shaping of steel. Both material and labor are saved. Here are some kinks in design of extrusion dies that will help you, when you apply the process

"Chip-less" machining, specifically cold extrusion, achieves marked economies, because of the saving in material, and because highly skilled operators are not required. At Tatra National Corp, Koprivnice, Czechoslovakia, the manufacturing-research group is constantly examining possiblities for cold extrusion in manufacture of automobile parts.

One application of cold extrusion is the manufacture of special wheel nuts with a spherical seating surface. These nuts, in various sizes, are made on CBJ hydraulic presses, which had been developed originally for working thermoplastics but were found suitable also for cold extrusion. Utilization of material by cold extrusion amounts to 70%, whereas the former hot forging and machining method used only 40%. Utilization of the material was uneconomical, the scrap being 60%.

For the manufacture of the size M 22 x 1.5 mm nut by the new working process, rolled 32 mm dia stock is cut to the required 16 mm length, on a turret or automatic lathe. This operation is followed by annealing in protective atmosphere, tumbling to remove scale, and phosphating. The slug thus prepared is inserted in a die and extrusion takes place in a manner such that both the external shape and the hole for the thread are produced. Extrusion is followed by piercing or drilling the 3 to 3.5 mm thick diaphragm which remains after extrusion, turning the spherical seating surface, and cutting the thread.

The shape of the nut required extra care in design of the tool. The difficulty was that the hole had to be pierced and, at the same time, the OD of the round slug had to be reduced to a hexagon. Because of these conditions a two-part tool was designed.

The upper part of the tool transmits pressure to the material against the bottom mandrel and the special die insert. At return movement the ring-shaped ejector is actuated by three pressure pins guided in the main body of the tool.

The material heats up during extrusion. In continuous operation, the tool temperature rises steadily, and annealing of the mandrel and the insert may take place. Therefore, the tool is provided with several holes for draining coolant into a sump, from which it flows into a tank with a pump.

Tool-Design Pointers

One of the most important points in design of the tool is the setting of the mandrel height in relation to the leading edges of the hexagon in the die insert. This distance amounts to 3.5 to 4 mm above the leading edge. Thus, shaping of the hexagon can be achieved while the material is still in a condition of flow. This reduces strain on the insert as well as the bottom mandrel.

Another, no less important design point is firm anchoring of the bottom mandrel, and the maintenance of the length-to-diameter ratio, which should not exceed 3:1. The mandrel is anchored in a taper-bored hold-down plate, and its bottom projects 0.3 to 0.5 mm beyond the plate.

Manufacture of Tool

Greatest care in manufacture of the tool must be devoted to the extrusion insert and to the bottom mandrel. The insert is made of Poldi tool steel, grade 2002, and is hardened to Rc-60. In the center of the insert there is a 32.5 mm dia hole through which the material is fed against the bottom mandrel. The hole is ground to a taper up to one half of its length for easier ejection of the nut from the insertion, and changes into a hexagon.

Good flow of material to the required shape, and

*Czechoslovak Heavy Industry, No. 5, 1956

the life of the bottom mandrel and the insert, depend on design of the hexagon. Therefore, the hexagon must be accurately aligned with the outside surface of the insert and perpendicular to the bottom surface. All radii at transition points must be maintained. The "cavity" must be polished to a mirror finish after hardening.

These conditions are best satisfied by broaching the hexagon in a fixture. At the bottom of the insert there is a recess to accommodate movement of the ejector.

On its outer surface, the insert is tapered 3° for a secure press fit into a chase, using 50 tons pressure. The press fit removes the risk of breakage from side pressure.

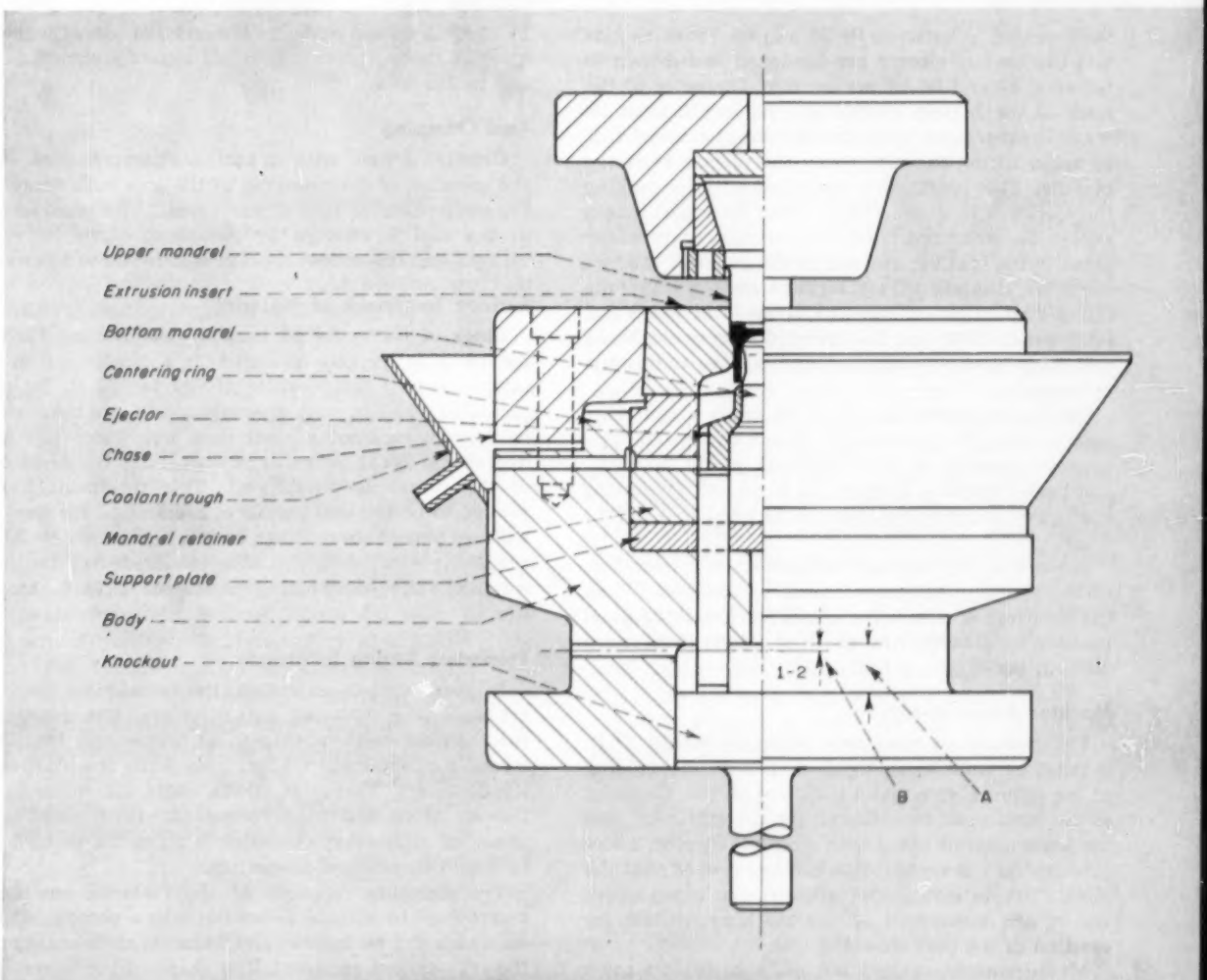
The bottom mandrel, made of Poldi tool steel and hardened to Rc 60-62, is designed so that its operating part consists of a flat surface and a cone, which changes into a cylindrical land with a mirror finish. Behind the land the mandrel is reduced 0.5 mm.

The free length of the mandrel should not exceed three times the diameter of the working part of the mandrel; thereafter, it changes to a larger and stronger section. The tapered part of the mandrel serves for centering and firm anchoring and for reducing the pressure upon a supporting plate. If radii at the transition points are not maintained and smoothly blended, the mandrel yields sideways during extrusion. The results are non-uniform wall thickness, and frequent mandrel breakage.

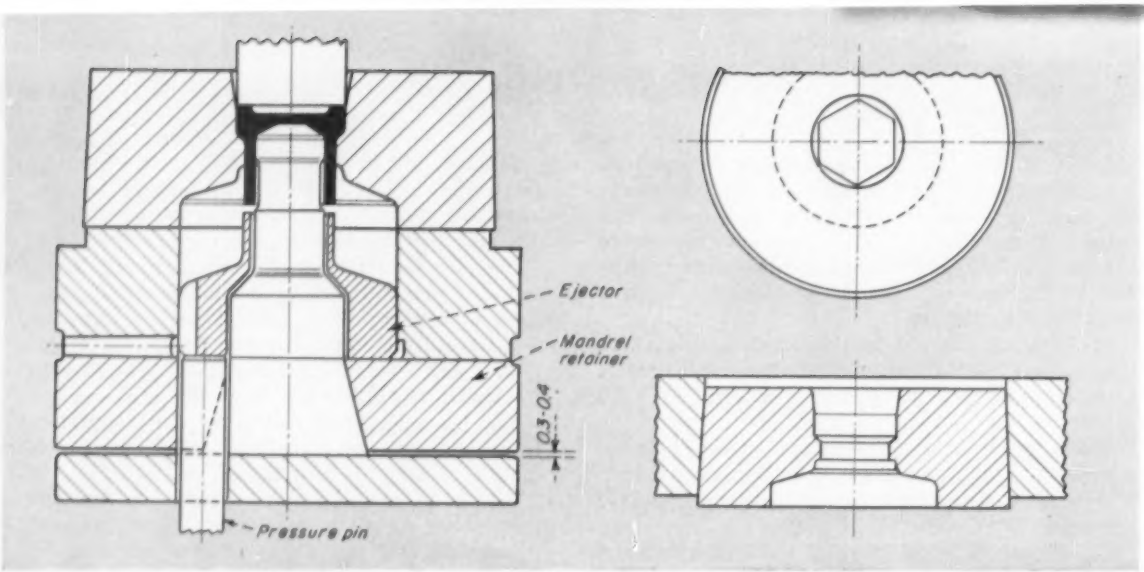
The bottom seating surface of the mandrel must be square with the centerline, and its tapered part must accurately fit its retainer.

The body of the tool is cylindrical. Six screws fasten the chase to the body. When the tool is assembled, the insert sits on the centering ring. This arrangement prevents the insert from working loose.

The centering ring, the mandrel retainer, and the support plate are made of Poldi EZH tool steel,



Extrusion die consists of a two-part tool embodying an upper mandrel or punch, a die insert and a lower mandrel, or piercing punch. *A* and *B* denote the bottom and top positions of the ejector



Bottom of the lower mandrel has a steep taper that is carefully fitted to the mating hole in the hold-down plate or retainer. This construction anchors the bottom mandrel, maintains its alignment which is essential for good tool life

Hexagon opening in the die insert is broached in a fixture. All radii must be machined accurately, smoothly blended, and the entire cavity must be highly polished

heat treated to between Rc 56 and 60. Pressure pins and the bottom ejector are hardened and drawn to between 80 and 90 kg per sq. mm. Diameter of the stem of the bottom ejector and its length must be made in accordance with the machine characteristics, to avoid lifting the tool when the ejector is at top position. This condition is complied with by making the ejector 1 to 2 mm shorter than its actual length should be, measured from the clamping plate of the press to the seating surface in the guide in the tool body. The ring-shaped ejector, by means of which the nut is pushed out of the tool, is made of Poldi tool steel, grade 2002, and heat-treated to between Rc 58 and 60. When it is manufactured, all the radii must be smooth.

The upper mandrel is tapered to fit a centering insert, which is attached by means of the nut. The mandrel is made of Poldi material, grade No. 2002, and heat-treated to between Rc 60 and 62. Operating portion of the mandrel must be polished to a mirror finish.

After the tool has been assembled, the operation of the ejecting equipment must be checked. When the knockout is released, it must return to its original position by gravity. And the ring ejector must move without cocking.

Machine Requirements

The press must meet several requirements. First, it must be sufficiently rigid, with accurate guiding of the upper platen and a sufficient stroke. Capacity of the press must be sufficient for the extrusion, and the press must be fitted with a bottom ejector. These ejectors vary in design. Practice has proved that the most suitable mechanical ejectors are those which the return movement of the machine utilizes for ejection of the part from the tool.

Measurements carried out on a hydraulic press with material of a tensile strength of 40 to 50 kg per sq mm revealed that the actual pressure required for the extrusion of the above-mentioned nut, size M 22 x 1.5 varied between 120 and 125 tons. On the basis of these figures, the press capacity should be 140 to 200 tons.

Tool Clamping

Closely linked with machine characteristics is the question of the clamping of the tool with means for prevention of lateral movement. The clamping of the tool is effected by means of three heavy clamps, and movement is prevented by three screws.

Surface Treatment of Material

Slugs of the required length, after having been cut on a lathe and annealed in a protective atmosphere at a temperature of 600 to 700 C, for a period of 2 to 3 hr with gradual cooling, are tumbled in a drum containing steel shot, hot water and a degreasing agent. After these operations the surface of the blocks is phosphated. This treatment has proved to be the best means of lubrication for steel, because phosphate coatings have a high capacity for absorbing lubricants, and thus a lubricating film is retained. The phosphating treatment extends tool life.

Properties During Extrusion

In the course of extrusion, the mechanical properties of the material change. Here, the general rule is that with a change of shape the tensile strength of the material increases while the plasticity decreases. Therefore, when parts are made by two or more extrusion operations, they must be annealed after every operation to allow the material to regain its original properties.

The structural changes of the material can be ascertained by macro- as well as micro-photographs on which the elongation and increase in fineness of the crystals are apparent. The shape of the fibers is regular, and it can be seen from their increase in density that individual parts of the nut have become stronger.

Round Table

Open Forum

"I see you finally got the new lathe installed and working, Al. How's it run?"

"Well, it's a good machine, Ed; but there's still a couple of things that should be changed. I'd like to see the engineer who designed it."

"What's wrong?"

"For one thing, there's a control knob on the panel that's in just the wrong spot. Every time Swanson reaches for the rear-slide tool control he skins his knuckles. They couldn't have picked a worse spot if they'd tried."

"Tell Swanson to slow down for a while, Al. He'll catch onto it."

"It doesn't make any difference, Ed. Besides, that machine's supposed to be easy to operate—it's one of their selling points. I'd sure like to ream out one of their designers about it."

"Tell Harrison, Al. He'll get after them."

"I wonder why we never see any of the factory people here, Ed. They ought to follow up on their equipment—at least new models."

"They do, Al. Trouble is, they just talk to the big shots. So you've got to make a complaint that will get back to the front office."

"Seems to me they ought to come around and talk to the actual operators, Ed. The guy who runs the machine is the one that can point out the bad features—the ones they ought to correct."

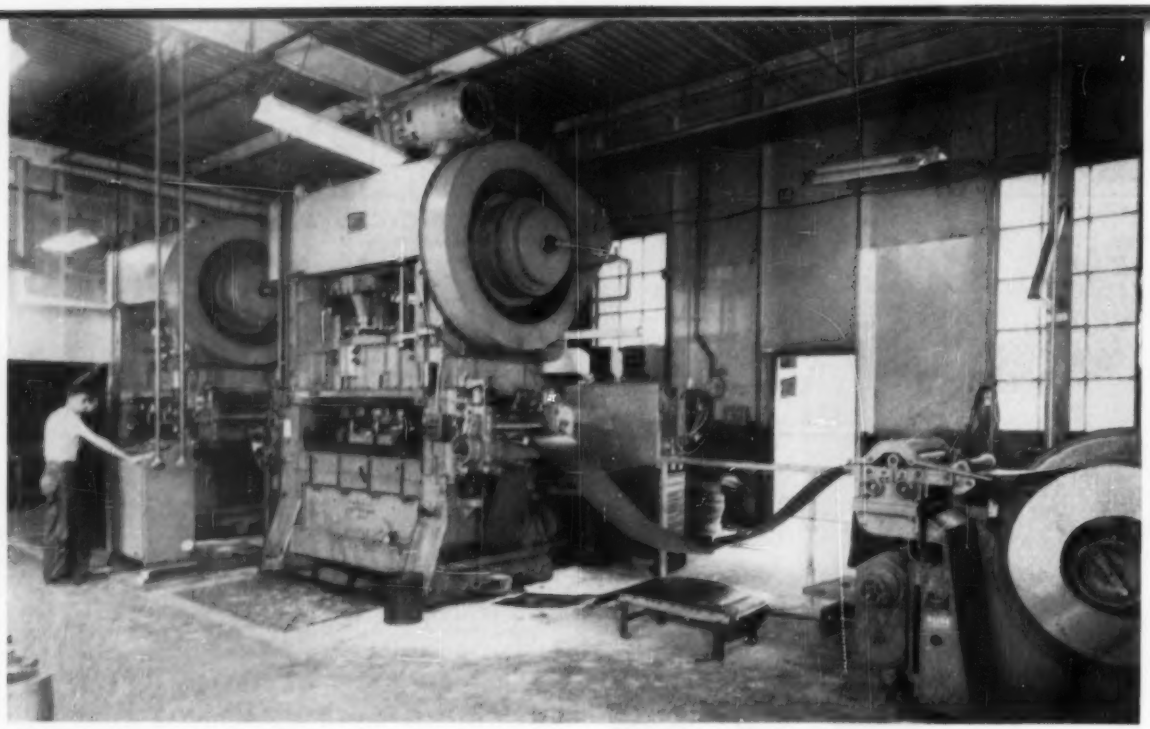
"Yeah; and most of the machine operators are just too eager to blow off steam about what's wrong with the equipment, which is probably why you haven't seen a factory representative here, Al. If there's anything really seriously wrong with the machine, Harrison will hear about it, and he'll tell the factory. Why should they waste their time letting an operator gripe about something? Maybe there's a good reason for the knob being in that spot—something you never thought of."

"I can't see what, Ed. If there is, they should have mentioned it in their literature. I've read that though and didn't find a single reason why the knob has to be in just that spot."

"Why don't you wait and see, Al? I'll bet Swanson will find out why it's there after a while."

"Maybe so, Ed; but by that time he won't have any knuckles left."

SHOULD factory representatives follow up their equipment more closely and talk to the real machine operators—or do they already? Perhaps Ed's idea to tell the supervisor about the problem is wiser. Your opinions may help others. Discussions of earlier topics start on page 137.



OPERATOR NORMALLY . . .
controls both presses from a pulpit. If necessary to run one press only, a selector switch at that press is set to "Independent"

Tandem press line

W A OKENFUSS, manager, Industrial Engineering, WAGNER ELECTRIC CORP, ST LOUIS, MO

Two high-production presses with a common drive make rotor and stator laminations, three of each per stroke, for synchronized production at lower cost

Savings that we realize from the tandem-press arrangement can be summarized as:

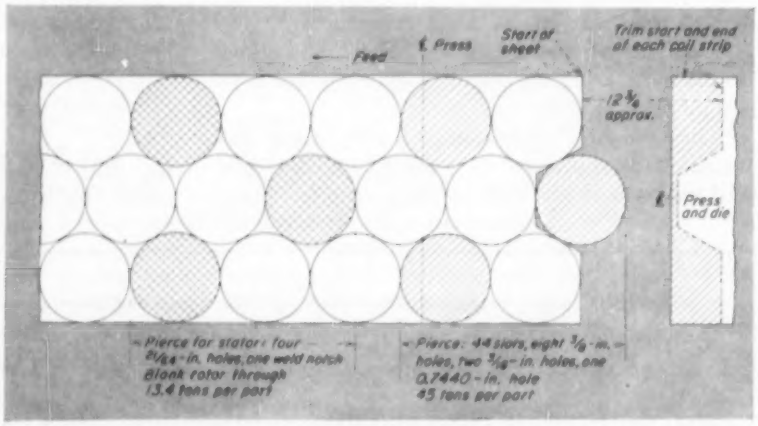
1 . . We can use progressive dies, but by making rotor laminations in one press and stator laminations in the other, we save the expense of one huge, extra-wide die, and the maintenance and handling problems that would go with it.

2 . . Two smaller presses, one of 250 tons and the other of 300 tons, cost less than a 600-ton press to handle the undesirable large progressive die.

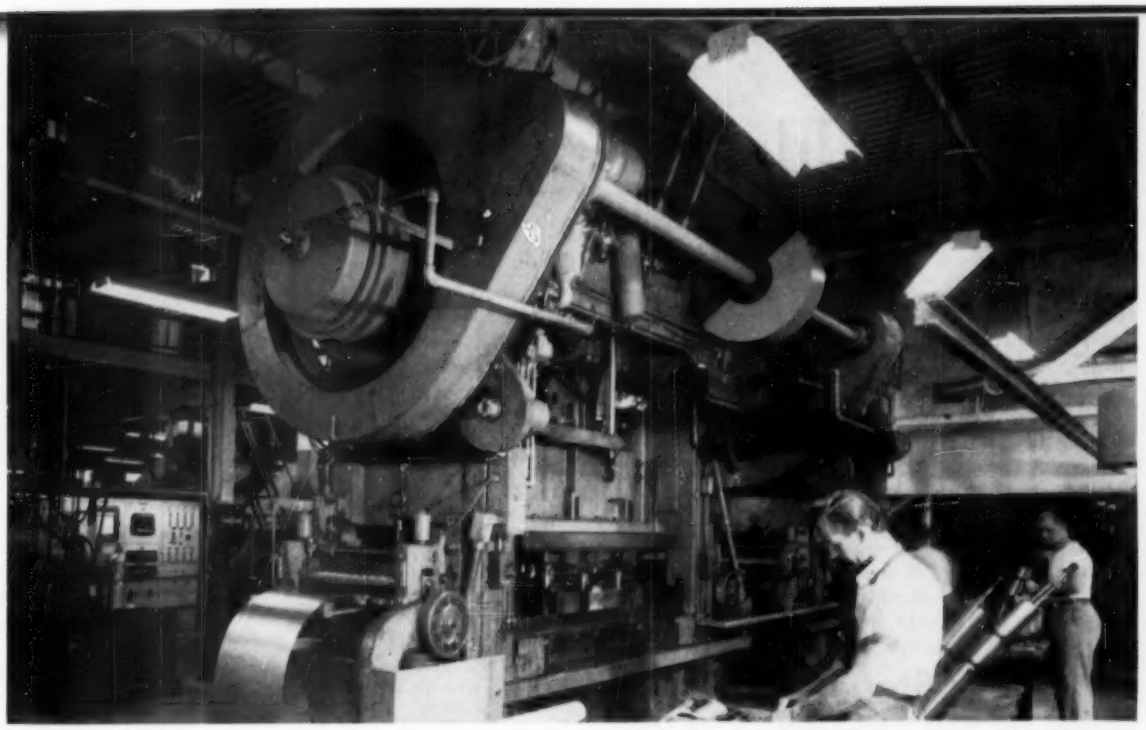
3 . . These presses operate at a faster rate than a 600-ton press. We run at 130 strokes per min. on the job illustrated, producing three parts per die, or a total of 390 pcs per min. of each part.

4 . . We enjoy the advantages of progressive dies, and the 5 to 7% saving in material that they will produce.

5 . . Progressive dies combine operations, to save labor and minimize inspection and rejects between operations.


Feed
℄ Press
Start of sheet
Trim start and end of each coil strip
12 3/4 approx.
℄ Press and die
Pierce for stator: four 21/64-in. holes, one weld notch
Blank rotor through
13.4 tons per part
Pierce: 44 slots, eight 3/8-in. holes, two 3/16-in. holes, one 0.7440-in. hole
45 tons per part

SCRAP-STRIP LAYOUT . . . ▶
for rotor blanking shows that 44 slots plus 11 holes are pierced at the first station. At the second station, four holes and one weld notch are pierced for the stators, and the three rotors are blanked through



LAMINATIONS . . .
are stacked automatically at the rear of the presses. The scrap skeleton is chopped up by a scrap shear and falls into a scrap box

saves 5 ways

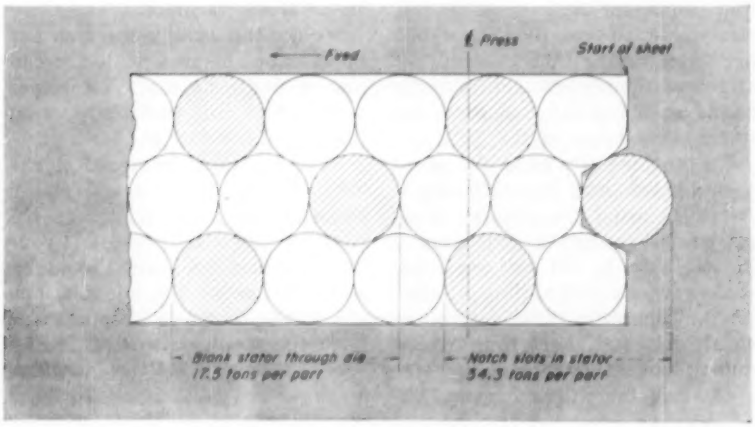
A common drive gives the necessary synchronization of both presses so that they always operate exactly at the same speed. The drive for the 250-ton press (rotor laminations) at right is extended through a jackshaft to the 300-ton press (stator laminations) at the left. Drive is by a 30 hp variable-speed drive to provide from 85 to 170 strokes per min., as required, when jobs are changed. All mounting and wiring of electrical equipment and controls conform to JIC standards. Presses will accept coil stock up to 24 in. wide.

Combination controls for both presses and drive motor are mounted on a separate pulpit. Both presses can be operated simultaneously under "dual control," only from the pulpit.

In addition, each press has individual controls—pushbutton stations mounted on the uprights. The presses can be operated individually on single stroke or jog but not continuously. Reversing action is possible only on individual control and jog buttons.

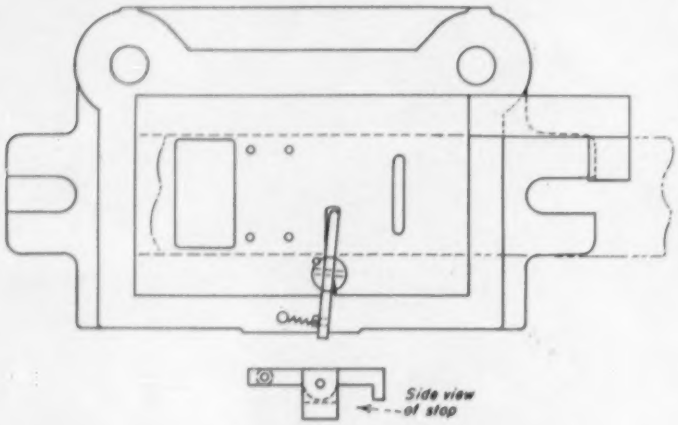
Operating the presses on "dual" makes the individual controls inoperative—except for the "top stop" button which will stop both presses at the top of their strokes.

Additional controls are set up for the control of steel coil stock from cradle to first press (speed of feed controls). There is an eccentric adjustment on both heavy-duty double-roll feeds to compensate for scrap stretch. Finally, there is a loop control between the presses to correct the contour of the loop.



ONLY THE STATOR NOTCHES . . .
require piercing in the second die. Total loads on the presses are well within their ratings of 250 and 300 tons, respectively

Practical Ideas . . .



Automatic Stop Is Self Contained

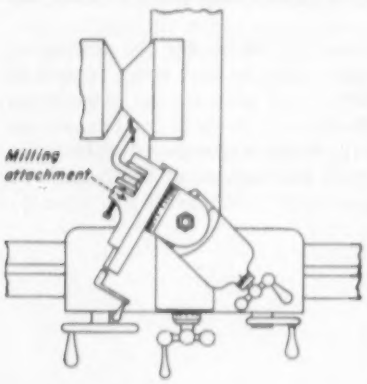
I studied with great interest your recent issue including an article on "How to Design Finger Stops" (*AM*—Oct 8 '56, p140). This reminded me of a stop I sometimes use under certain conditions, as in place of a long hole for a pivot pin or where dowels or bolts interfere with installation.

When the first station on a progressive die pierces a large hole or a slot, this stop, which is self contained, can replace a finger stop as well as function automatically in successive operations. Consequently, one stop does the work of two.

The illustration shows the top of the die with the stripper in place. The stop unit is mounted through the stripper, located and secured by a grub screw. A spring post is inserted in the die shoe, and a spring is mounted on it to give the stop an upward and sideward pull.

The stop can thus be placed at the second station instead of at the blanking punch, the more conventional location.

George A Jonas, Glen Oaks, NY



Milling Attachment On Compound Produces Back Angle In "V"

We have been running a precision lathe job in our shop. It required taking a cut on each side of a wide V-groove.

It was inconvenient to cut one side of the "V" and then swing the compound to a new angle to cut the other side. In addition, this method required great care in setting the compound at the correct angle before each cut.

We solved this problem by mounting a commerical lathe milling attachment on the lathe compound, as shown in the drawing. The compound slide is set at the correct angle to machine the right-hand side of the "V". The milling attachment is mounted on the compound at the angle corresponding to the second side of the "V".

To machine the part, the compound is fed along the right side of the "V", using the regular compound-rest feedscrew. The second, or left side, is cut by using the feedscrew on the milling attachment. This setup turns out an accurate job, and saves time by reducing tool setups.

Clint McLaughlin, Queens, NY

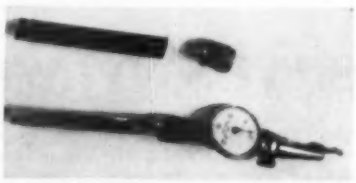
Simple Arithmetic Finds Tap-Drill Size

To find the drill for any size tap, just place a 1 over the number of threads, and subtract the result from the tap size. For example: a 1-in. 8-tpi tap, place a 1 over the 8 to get ⅛. Subtract ⅛ from the tap size which is 1 in. will give us a remainder of ⅞ in., the tap-drill size required.

In the case of a fractional-size tap for example, ½ in. 12 tpi, ½ in. minus 1/12 is 6/12–½=5/12 or .416=27/64 drill.

This method is especially valuable for large taps, that are not shown on tap-drill charts, or where there is no chart handy.

Harry Josephs, Gardenville, Penna



Indicating Made Easier With Toolbit Adapter

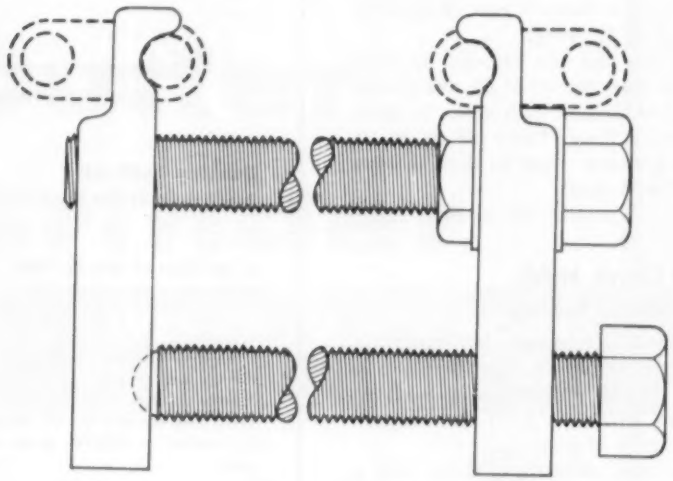
It is considerably easier to use an indicator when it can be held in the toolholder. The devices commonly used, such as a clamp or a magnetic base, are cumbersome by comparison.

The adapter we made was a great improvement, and is much faster and easier to use. When work has to be checked, simply remove the toolbit from the toolholder, and insert the adapter with an indicator in its place.

We use this arrangement on our small lathes at present, but it can just as easily be made for larger lathes. The only difference is in the size of the toolbit.

A ¼-in. toolbit is brazed or silver soldered to a spare sleeve adapter. (A piece of square CR steel may do just as well.) If your indicator has no male thread on which to mount the adapter, one can easily be made or purchased from the manufacturer.

H J Gerber, Stillwater, Oklahoma



Clamp Eases Conveyor-Chain Repairs

This clamp is used in our shop when repairs are made on our conveyor chains. It used to be quite a task to hold the tension on the chain while links were replaced. It was too heavy to hold by hand, so many rigs were tried but without much satisfaction before this clamp was made.

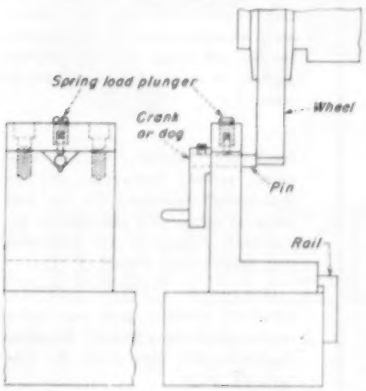
The basic principle of the parallel is used, incorporating a pair of hooks as near the clamping screw as permissible. With long enough screws, this clamp will easily bridge a broken section, holding each end rigidly for repair.

Construction of the clamp is as heavy as possible, for it may be called on to do some heavy pulling. The clamping screw is provided with a jam nut and washer located on the inside of the stationary jaw. When the jam nut has been located to allow free motion of the bolt, it may be pinned. The pin must not be so big, however, that it will weaken the screw.

The jacking screw is similarly heavy, with a pilot on its forward end to fit into a shallow socket on the movable jaw. The fingers are made to hook onto the chain rollers, as the drawing shows. Their leading-end thickness is about ⅛-in. less than the distance between two adjoining rollers, and the width is made with about the same clearance.

The operation of this clamp is much the same as the operation of an ordinary parallel clamp. After the fingers have been hooked into a pair of good rollers on each end of a break, the screws are manipulated as usual.

Frank L Rush, Columbus, Ohio



Notched Angle Plate Holds Centerless Pins Concentric

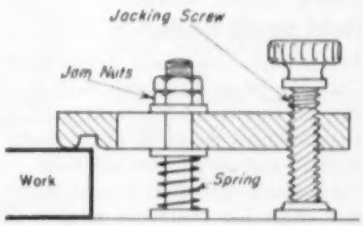
We sometime have to take a few tenths or a few thousandths off the dia of small pins at either or both ends. Without centerholes, the pins are difficult to keep centered when standard gripping methods are used.

One way to hold them is to locate them in the bottom of a V-notched cut in an angle plate. The plate is mounted on a surface-grinder table, against the back rail, positioned under the wheel for stock removal. A spring plunger assembled in a hole through the clamp bar over the center of the V-notch keeps the pin in position. This keeps the pin rotating concentric, and also allows taking it out for inspection.

A small dog, or handle, is attached to each pin to be ground so it can be rotated. The hub of the handle should at all times bear against the face of the angle plate.

Tapers can be produced by shimming the angle plate or placing it on a magna sine.

Ottavio Cerullo, East Boston, Mass



Improved Strap Speeds Setup

Common straps are fine for holding work to the machine table, but shifting these straps to relocate the work means a lot of manipulation added to the working cycle.

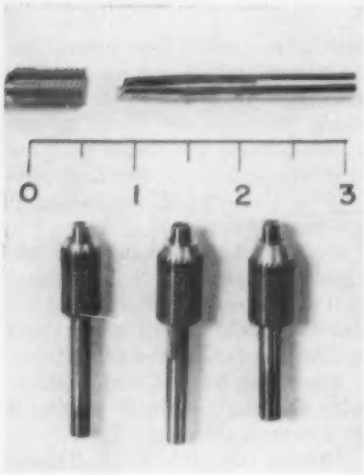
I have made and used straps like the one shown for years. It is quick-acting and has saved me many hours in setup, and is particularly useful when the price of special fixtures is prohibitive.

To make a strap of this kind is simple. The only machining difference from a standard strap is a tapped hole in the far end for a jacking screw. The strap is spring-loaded; that is, a washer, a spring, and another washer are placed on the stud before the strap to maintain the strap in an open position when released. Two jam nuts are used on the stud to lock height where desired.

The jacking screw is provided with an oversized knurled knob, eliminating need for a wrench. It's a good idea to equip the screw with a pad to protect the table.

Federico Strasser, Santiago, Chile

Practical Ideas



Easily Made Chucks Hold Small Drills

Every man who uses drills from sizes No. 60 to 80 knows that they can be mighty difficult to hold if the standard chuck is at all worn. Myself included. The addition of these small-size drill chucks to my tool chest has therefore proven to be a good investment.

A set of three chucks was designed to hold drills from 3/64-in. dia to No. 80. Because of their small overall dia they can be used in close places. They are easy to make because no threads are used, and depend entirely on friction for holding the collar after the chuck is closed.

I made the shank for the smallest chuck of ¼-in. drill rod, 2¼ in. long. One end was turned to 3/16 in. dia with an included angle of 6°. The blank end was then chucked and trued in an indexing head. Three 1⅛-in. long slots were cut with a 0.020-in. wide slitting saw, 120° apart. The burrs were carefully cleaned off and flats 1/16-in. wide were filed along the slots on the taper.

The collar was turned from drill rod to a finished dia of 7/16 in. and knurled. A hole less than 3/16 in. was drilled through the full length of the collar. It was then counterbored to within ⅛-in. of the bottom with an ID of ¼ in. The remaining part of the through hole was bored with a taper to match that of the shank, and with a dia to allow the shank to protrude ⅛ in. A 30° taper was then put on the forward end of the OD, about ⅛ in. long.

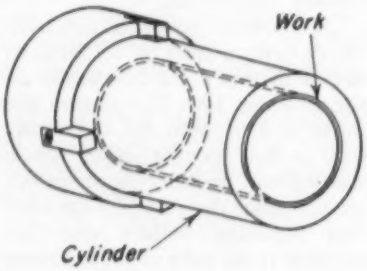
In making the chucks to hold drills from No. 60 to 69, the shank must be drilled with a No. 60 drill before slitting. The 3/64 in.-to-59 chuck shank must be drilled with a 3/64-in. drill.

R I Wessells, Baltimore, Md

Pot Chuck Holds Thin-Wall Tubing

A small number of large-dia stainless-steel tubing had to be rebored. The object was to remove about 0.020 in. from the original thickness of 0.045 in.

It was decided to bore out a pot chuck from a large piece of an available graphite cylinder. The cylinder was securely mounted in a 4-jaw chuck of a large lathe, and bored out to 0.002-in. larger



than the OD of the tubing. ID of the tubing before machining was 12.063 in., and their length was 10 in.

The slightly elliptical form of the tubes was enough to hold them securely in the pot chuck through spring action.

The bore was then completed, leaving a wall thickness of 0.025 in Two passes were used to remove a total of 0.020 in. without movement of work in the chuck. The finished work was removed with the use of liquid nitrogen, which caused the tubing to shrink, making extraction easy. Gloves should should be worn for protection.

This was an easy and inexpensive method of reworking thin-wall sections next to impossible to hold for machining by any other method.

Herbert V Ross, Lemont, Ill

Winner No. 261

won **$25** in addition to regular payment for his idea:

Buckley Sullivan
Bending On Screw Machine

in the issue of Oct 22, 1956

An extra payment of $25 is made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y

Ingersoll Cutter Grinder

SAVES UP TO 5 1/2 HOURS OF EVERY WORKING DAY

Customers using the new Ingersoll Cutter Grinder report time savings of 24% over older Ingersoll machines and up to 70% over standard tool grinders . . . 2 to 5½ hours of an 8-hour working day.

How do your grinding times compare with these?

12 minutes
6" Type NX
10 HSS blades

40 minutes
10" Shear Clear
20 T.C. — tipped blades

50 minutes
10" Shear Clear
38 T.C. — tipped blades

To demonstrate time savings available in your grinding room, we would like to actually sharpen some of your cutters on a new Ingersoll Cutter Grinder. Just write and ask us to have an Ingersoll cutter engineer make the arrangements.

WRITE TODAY FOR CUTTER GRINDER MANUAL 64K

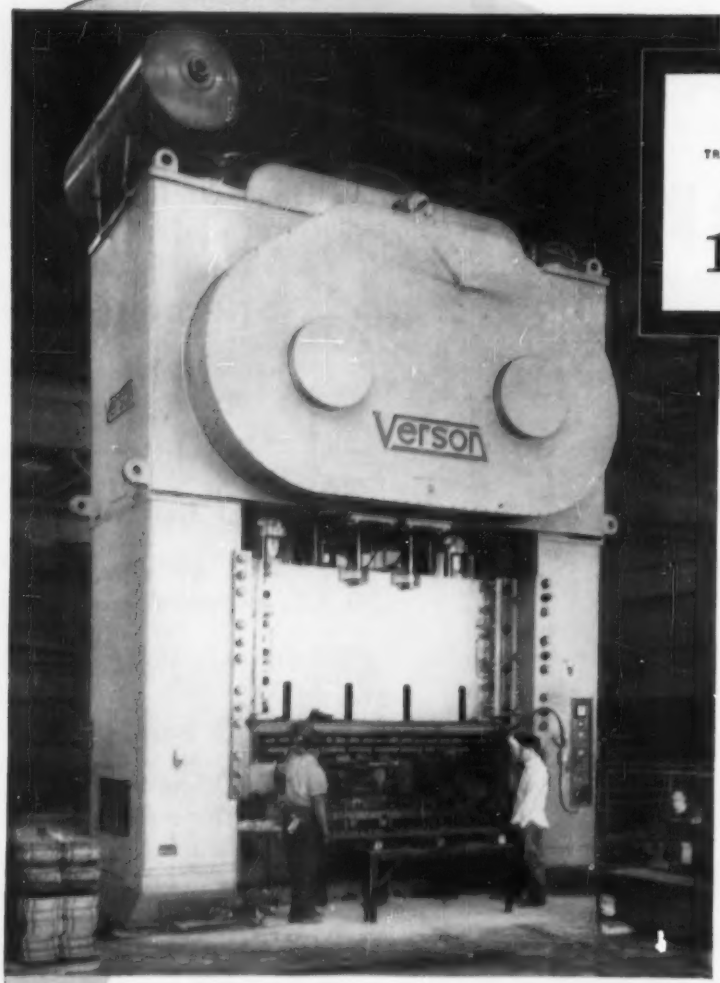
THE INGERSOLL
MILLING MACHINE COMPANY
ROCKFORD, ILLINOIS, U. S. A.

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES
ORIGINATORS OF SHEAR CLEAR CUTTERS

Front to Back Crank Arrangement of this

TRADE **Verson** MARK

1800 Ton Press



eliminates need for extra long shaft

Verson Presses offer features that bring accuracy, dependability and economy to a wide range of metal forming operations. The Verson Allsteel Frame, anti-overlap clutch and brake unit, square type gibs and non-oscillating vertical type adjusting screw are examples of the engineering and design that are a part of every Verson Press.

The press illustrated is a Verson 1800 Ton, twin gear, double crank. Two crankshafts are arranged front to back to eliminate the necessity of an extra long crankshaft. Gearing for the press can be installed and removed through the front of the crown allowing installation in areas with low overhead clearance. The machine was built to J.I.C. standards and has all electrical wiring and equipment, lubrication piping, air piping and controls installed internally.

We will be pleased to recommend Verson Presses to fit your production process. Just send an outline of your requirements.

A Verson Press for every job from 60 tons up.

TRADE **Verson** MARK

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9316 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • 8300 S. CENTRAL EXPRESSWAY, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

American Machinist **REFERENCE BOOK SHEET**

HOW TO "SPREAD THE WORD"..I

COURTESY ROCKWELL MFG CO

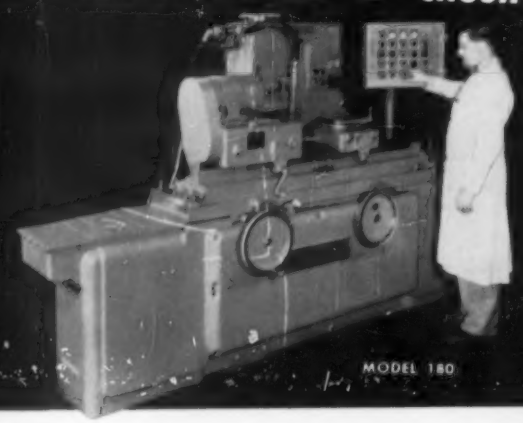
Systemized methods are required to "spread the word" in any organization, and to that organization's suppliers, customers, employee families and the community in general. Much more attention to "communications" from top to bottom, from bottom to top, and between departments is now the goal of progressive management. The accompanying checklist of what should be done and how it is done, and who gets the information was developed by the Rockwell Mfg Co for its own situation—a multi-plant company operating in several states and making a large number of products for an even larger number of markets. A policy is followed of almost total disclosure of operating information to various levels of management. Most of Rockwell's methods may be used by other companies, but that concern has tailored the methods to the needs of a diversified, decentralized organization. However, this checklist, one of the most thorough analyses that has appeared, can be tailored to your own needs.

COMMUNICATIONS CHECKLIST

METHOD	PURPOSE	WHAT IS COMMUNICATED	TO WHOM
President's staff meetings; weekly	To review current operations	Discussion of progress of programs, and matters affecting current status of company, initiation of programs.	Top executives and operating men at headquarters
President's letter; monthly. Prepared by president and his staff.	To keep management informed of current operating status, long- and short-term planning, and the president's thinking on matters affecting company.	Analysis of previous month's operations compared with preceding figures; analysis of inventories and inventory outlook. Matters of current interest: industrial relations, purchasing, public relations, engineering, etc. Personnel changes.	Vice presidents, corporation department heads, plant managers, sales executives
Division vice president's letter; monthly. Prepared by division vice president.	Same as president's letter.	Patterned after president's letter. Provides information pertinent to sales and operations in the division.	Divisional department heads and plant managers, sales managers
Management Newsletter: quarterly. Prepared by president and his staff.	To discuss current and anticipated operations with a wider group throughout the company.	Patterned on president's letter. Analysis of previous quarter's operations; sales forecasts and discussion of changes anticipated to meet new forecasts. Plant budget information, including complete analysis of actual costs compared to budget on such items as shipments, cost of sales, overhead, plant operating profit. Management tips submitted by personnel throughout the company. Subjects of current interest, e.g. training programs, new plant production, product development.	All management personnel from board chairman to foreman.
Activity report; monthly. Prepared by plant manager and his department heads.	To inform headquarters of plant's programs, progress and problems.	Information on production plans, programs in the plant.	President, vice president, staff department heads.
Annual management meeting; 3-day meeting conducted by president; 3-days by division vice-president.	To inform plant managers and sales organization of company-wide policies and plans for long term, and provide an opportunity to exchange information.	President's review of five years, past and future, including comparison of two year balance sheets. Review of staff operations: industrial engineering, purchasing, advertising, industrial relations, insurance, credit, etc.	Plant managers, corporation staff men, regional sales managers.

Continued on page 101

Grind PRECISION FORMS, GROOVES and LANDS *in Record Time* with SHEFFIELD'S CRUSHTRUE MULTIFORM GRINDERS



MODEL 180

MODEL 109

Servo Mechanism Sleeve

The seven grooves of this servo mechanism sleeve are crushtrue ground from the solid to a tolerance of .001" on spacing and .002" on minor diameter in 55 seconds. Material, SAE 52-100; Rockwell, 58-60 C; depth of plunge grind, .145".

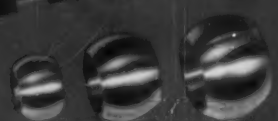
Forms and grooves are precision ground on these machines with comparable speed and economy.

For complete details write to Department 1, The Sheffield Corporation, Dayton 1, Ohio, U.S.A.

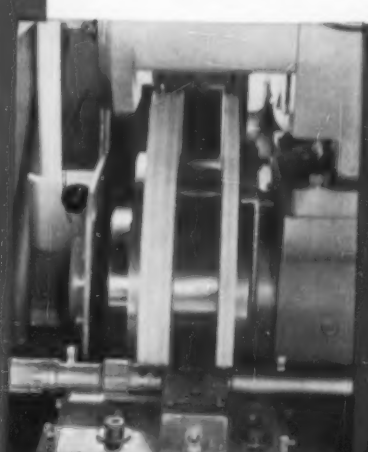
Bearing Race

Aircraft Servo Component

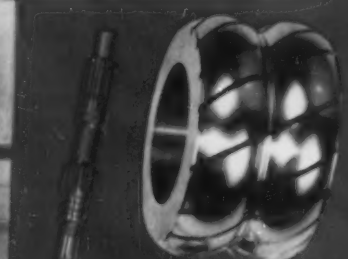
Hydraulic Servo Units



Self-aligning Bearings



Grinding Grooves in a Transmission Shaft



Crushtrue Roll

MASTER CRAFTSMAN GOLDEN ANNIVERSARY HEADQUARTERS

SHEFFIELD

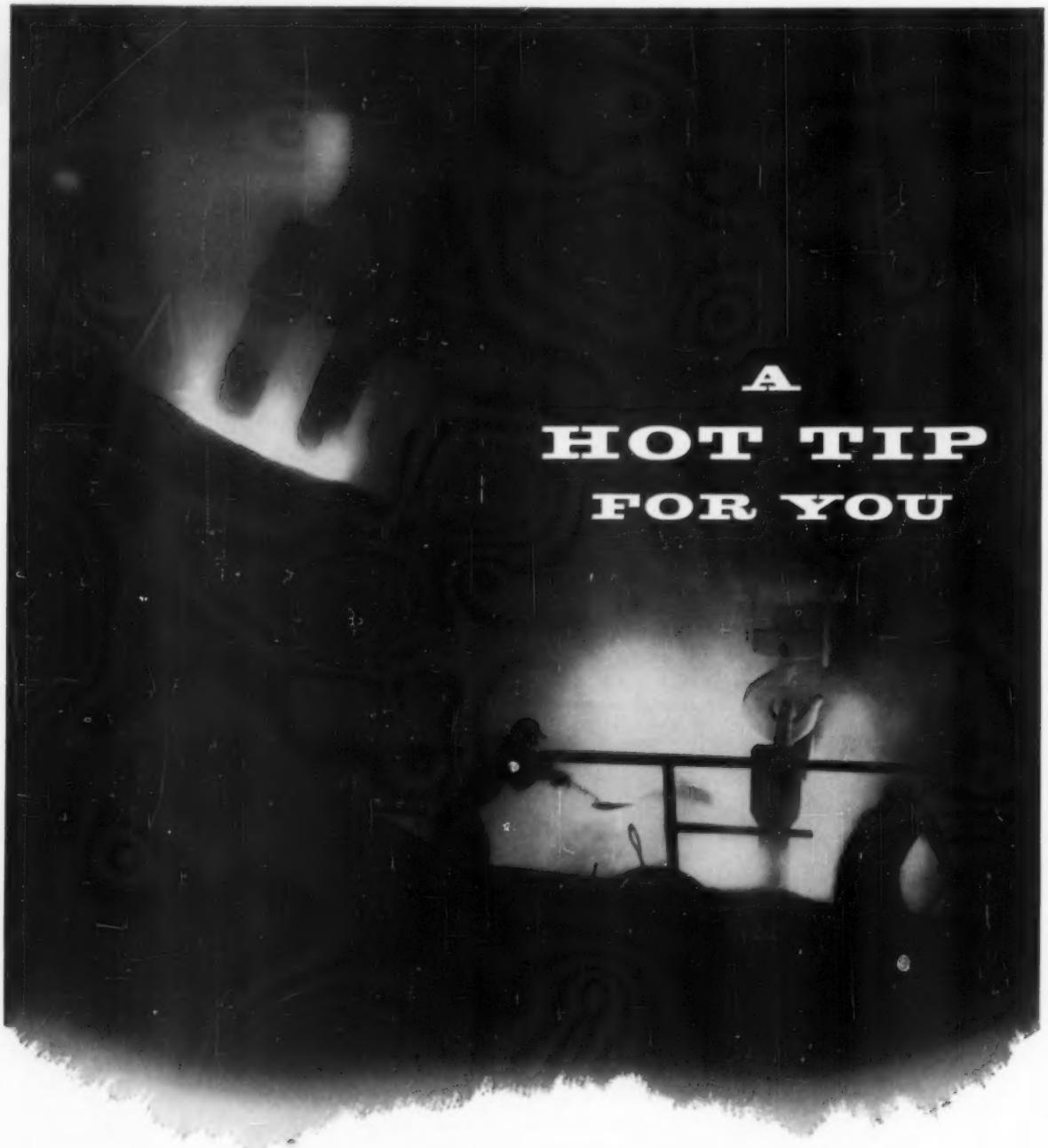
Manufacture and measurement for machines

American Machinist REFERENCE BOOK SHEET

HOW TO "SPREAD THE WORD".. II

COMMUNICATIONS CHECKLIST continued

METHOD	PURPOSE	WHAT IS COMMUNICATED	TO WHOM
Employee meetings; quarterly; conducted by president.	To keep all employees informed of company's status and plans and personnel policies.	Management's thinking on diverse subjects affecting employees, e.g. general business conditions, vacation policies.	All headquarters employees.
Research development report; quarterly.	To keep all divisions informed of all company product developments and plans; standardization program.	News of product developments and central and plant research laboratory projects and divisional engineering departments; news on standardization program.	Management group including department heads.
"HOUR OF ENLIGHTENMENT" meetings; bi-weekly.	To keep executives informed on operations outside their own fields; training in specialties of staff men.	General information on operations e.g. Controller discusses standard cost system.	Non-homogeneous group of middle management line and staff men.
Supervisory conferences; held at department head's discretion.	Seek solutions to operating problems	Discussion of specific operating problems as they arise.	Department supervisors.
Letters to supervisors.	To inform supervisors of specific operating problems as they arise; to pass along worthwhile ideas.	Announcements of new vacation policies, etc.; new procedures e.g. for merit evaluations.	All supervisors at their homes.
Report by president; monthly.	To acquaint general public and business community with company operations.	Informal monthly column including general information on company's philosophy of business and company activities.	An advertisement in business magazines and newspapers circulating to employees, customers, suppliers, stockholders and the business community in general.
Local report by local plant manager.	Same as above report.	Information of interest to the specific community.	Advertisement in local newspapers.
Company-wide house organ	Encourage "community spirit" in the company; provide a media for explaining company policies, attitudes.	News of employees' activities; management's views on general problems affecting operations; features concerning safety, waste, suggestion program, etc.	All employees.
Local house organ	Same as company-wide house organ.	Same as company-wide house organ.	All employees of the particular plant.
Internal publicity releases	Inform key employees of company activities that make the news.	All news bureau releases to general and business publications, plus news releases of internal interest.	Management group, including department heads.
Bulletin boards	Inform employees of matters of general interest.	Information on plant social activities, company-sponsored neighborhood activities, safety information, internal publicity releases.	All employees.
Employee letters	Encourage "community spirit" in the company.	Holiday greetings, notice of community affairs, reminders to vote.	All employees (at their homes)



● Electric arc furnaces represent the greatest degree of refinement of any steel-producing method. More rigid metallurgical controls are possible in the electric furnace and, therefore, assure you the highest, most uniform quality in your steel. A leader in the use of the electric furnace, Copperweld offers the most diversified selection of hot-rolled blooms, bars and billets of both leaded and unleaded alloy and carbon steels.

ARISTOLOY STEELS

COPPERWELD STEEL COMPANY
Steel Division • Warren, Ohio
EXPORT: Copperweld Steel International Co., 225 Broadway, New York 7, N.Y.

American Machinist REFERENCE BOOK SHEET

CHECK LIST FOR DESIGN OF SUB-ASSEMBLIES

The following check list will serve as a helpful guide in reviewing a design:

1..Keep the number of separate pieces in a sub-assembly as low as practicable by combining single components into one assembly if functional requirements permit.

2..Check particularly left- and right-hand parts to determine if they can be made identical and so avoid stocking an extra part.

3..Check advisability of using lockwashers assembled to bolts as purchased assemblies.

4..Check to determine if similar parts between models can be standardized.

5..If sub-assemblies require alignment, the parts should be designed to secure such alignment without the use of special jigs, by providing tabs, shoulders, notches or contour locators.

6..Provide adequate clearances between parts for assembly tools.

7..Provide clearances between parts where practicable, to allow for tolerance stack-up variations.

8..Specify the simplest, most effective and least costly type of attachment practicable and commensurate with the functional requirements. Cost analysis of attaching parts should include cost of parts, cost of assembly labor and amortized cost of any special assembly tools required.

9..Avoid blind riveting operations wherever possible.

10..Where rivets are used, provide sufficient clearances between parts and from flanges to permit use of a standard riveting gun.

11..Avoid use of slotted nuts and cotter pins wherever possible.

12..Standardize as far as practicable on bolt and thread sizes. Hold number of bolt lengths to a minimum and recheck frequently to reduce number of lengths in use. Avoid smaller sizes because they are difficult to handle and losses on this class of material are high.

13..Avoid novel, freak or trick types of sub-assemblies and methods of attachment.

14..Try to avoid arc- and gas-welding operations in shop areas where this type of equipment is not normally used. To specify these operations may involve additional movement of material from one department to another.

15..Do not specify lubrication of parts of an assembly which require processing in hot alkaline cleaning baths, etc.

16..See that no materials such as leather, fiber, etc., are specified to be part of an assembly that will be subject to alkaline cleaning or high-temperature baking operations.

17..Do not specify sub-assemblies that are so weak structurally that they may be damaged while being handled in the shop.

18..See that parts, which have to be hung on a moving conveyor for cleaning, plating or painting operations, have holes or other positive locations for hanging on conveyor hooks; also, provide means for drainage.

19..The designer should view an assembly as a grouping of parts to facilitate production. Each part in the assembly should be designed to hold the number of manufacturing and assembling operations to the minimum. This in turn will have a resultant effect on the amounts of equipment, manpower, materials handling and floor-space required for producing the end product.

If you machine parts like these...

we can save you UP TO 30%

...with Ryerson leaded steels

If you machine carbon or alloy steels for production or maintenance applications—you should be able to make substantial savings by switching from a standard steel to a Ryerson *leaded* steel.

We can tell you about customers who produce up to 50% more parts per machine hour, now that they have changed over to a leaded steel recommended by Ryerson. Others report tool life lengthened as much as 300% . . . rejects reduced to all-time lows . . . machine down-time slashed . . . finishing processes eliminated.

The nation's largest stocks of leaded steels in a wide range of types and sizes are ready for quick shipment from Ryerson. (See listing below.) Each is the fastest machining steel of its type available anywhere. If you are not now using leaded steels, it will be worth your while to investigate the possibility of adapting one of them, or several, to your operations.

A Ryerson representative will be glad to work with you. Show you dozens of case histories—good hard facts that document just how well Ryerson leaded steels have worked out under actual shop operating conditions. Call your nearby Ryerson plant.

LEADED STEELS IN STOCK

CARBON STEEL BARS

Ledloy (Screw Steel) . . . Cold drawn rounds, squares, hexagons.

Rycase (Case Hardening, Low Carbon, Manganese) . . . Cold finished rounds.

ALLOY STEEL BARS

Rycut 20 (Low Carbon, Case Hardening) . . . Hot rolled and cold finished rounds.

Rycut 40 (Medium Carbon) . . . Hot rolled and cold finished rounds, annealed to heat treated and stress relieved.

Rycut 47 (Medium Carbon) . . . Hot rolled, annealed rounds.

New Rycut 50 (Medium Carbon) . . . Hot rolled and cold finished rounds in annealed condition, hot rolled rounds heat treated and stress relieved.

Leaded 8620 . . . Rounds hot rolled, cold finished.

Leaded 4140 . . . Rounds, cold finished, annealed or heat treated and stress relieved.

Leaded 8647 . . . Rounds, hot rolled, annealed.

CARBON STEEL PLATES

New E-Z-Cut Plates (Hot rolled, low carbon, manganese.)

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • WALLINGFORD, CONN. • PHILADELPHIA • CHARLOTTE, N. C. • CINCINNATI CLEVELAND • DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

Talking Shop . . .

Skin Dive for Test

AIRPLANES AND SKIN DIVING might seem to have little in common, but Boeing recently needed ten skin divers to aid in the hydrostatic testing of the KC-135 fuselage. Pete Boston, who heads manufacturing training at the Seattle plant, was prepared to start a training course in skin diving until he remembered what a popular sport it has become. He found enough skilled skin divers in the company, only found it necessary to drill them in the techniques of testing the fuselage.

This sidelight on Boeing's training program indicates the variety of the manufacturing training program. More than 1000 electronic technicians will be needed at the Seattle-area plants in the next two years. In-plant training started in 1948 when it was found that poor riveting was responsible for 50% of rejections. Riveting classes were started and the rejection rate began to drop. The program has been extended until now the Seattle training school requires 45,000 sq ft of space and about 70 full-time instructors who teach 75 different courses. Some of the instructors are ex-teachers, but all have worked somewhere in the factory and know factory problems.

Struck Union

PROOF THAT EVEN A UNION is powerless against a woman aroused was demonstrated in Detroit last month. Two women employees of the UAW's Tool and Die Council office staged a walkout and picketed the office for four hours, charging that a "speed-up" had been instituted. The two women, representing the entire clerical force, finally went back to work after a three-hour conference with the secretary of the International Union of Office Employees, of which they are members, and James Shaner, president of the Tool and Die Council.

The women charged "we couldn't take it any longer," and said that since new officers took charge of the council they had been overworked. A third office worker was recently fired in a reduction of the office force, the angry women charged.

"Although we agree that our walkout was not authorized," one of the women said, "it was based on real grievances which will become strike issues if they are not corrected."

The women charged that there was "far too much work for two women to do and when we got behind everyone shouted at us."

It must be that all the new officers of the Tool and Die Council are single men; any married man knows you can't shout at a woman and wind up having the last word.

Altered Temper

ALUMINUM HAND FORGINGS with a low level of internal stresses are possible with a new tempering process developed by Alcoa. The –T65 temper, which replaces –T6 in X7079 alloy is said to reduce internal stresses and cut warpage from machining. There is hope, Alcoa says, of extending the advantages of the –T65 temper to other alloys,

Shrinking Nickel

THE "SHRINKABILITY" of aluminum is well known. Thus, a wrinkle may be removed from an imperfect flange by hand work that involves increasing the thickness and reducing the area. Titanium, in contrast, is relatively "unshrinkable" and hand work is confined to moving wrinkles from one spot to another (as into the trim area). Now comes word that Finn Aeronautical Div has a "stretch-shrink" process of forming Inconel W into multiple contours while keeping it uniformly thick. The method involves careful layout of sheet-metal parts for a combination of welding and controlled rolling. A thickness can be controlled, they say, to ± 0.002 in.

Supervisor Survey

IN A POLL of delegates to the national conference of the National Management Association, 404 supervisors rated, in order of importance, several things that might be done to improve the supervisor's job. Highest priority, with 36% of the first place votes, went to "more and quicker information from top management on policies and decisions." Another 26% thought that the most important thing was "better understanding of just what is expected of the supervisor." Low votes went to more training (15%), more pay (3%), and more authority (2%). These votes were taken to mean not that the supervisors were not interested in more training, pay, and authority, but that they were more concerned about the inter-management relationships.

Cold Magnet

AN ULTRA-POWERFUL MAGNET constructed at Los Alamos Scientific Laboratory was discussed at the 1956 Cryogenic Engineering Conference by Dr H L Laquer of the University of California. Ultimately it is hoped that this magnet will be used to cool matter to temperatures lower than any previouly attained. This magnet differs from most electromagnets in that it requires only 1/100 of the electric power needed to operate a room-temperature magnet of equal size and force. When cooled to liquid hydrogen temperatures, the magnet coils are electrical conductors.

Fixture Protection

A SIMPLER AND BETTER method to protect fixtures stored outdoors has been developed by Grumman Aircraft. Wooden plugs are inserted in bushings and vital holes, then the fixture is prepared with a prime wash and sprayed with 3 to 4 mils of vinyl paint. The plugs are then removed and the holes sprayed with a strippable vinyl coating. Previously Grumman covered fixtures with bituminous paper, masking tape, and four to six coats of plastic film. Air trapped in the cocoon caused surface oxidation despite the protection.

Gateway to a new life . . .
Camp Kilmer may be a sea of mud and a huddle of dreary disused Army barracks, but to Hungary's Freedom Fighters it's a beautiful sight

Five metalworkers enjoy their first American meal . . .
Every one of the five young Freedom Fighters seated at this table in the Refugee's Mess Hall at Camp Mercy was employed in Hungary's Metalworking industries. From left: (hidden from view) is a toolmaker, then a tractor driver for a metalworking plant, a lathe worker, a metalworking plant bookkeeper, and an automotive mechanic

Hungary's Freedom Fighters — a Boon

CAMP KILMER, N J—"When I get back to Cleveland, I'm going to light a fire under the Chamber of Commerce and industrial groups. Just look at the caliber of these Hungarian refugees—they're just what industry has been crying for, yet I haven't heard of a single Cleveland company that's made a firm job offer to these people."

The speaker is Congressman Charles A Vannick of Cleveland, who's come down here along with three or four of that city's prominent Hungarian businessmen and civic leaders, bringing lists of Cleveland Hungarians who have offered to feed, house and take care of the Freedom Fighters and their families.

The spirit and the caliber of the Freedom Fighters *are* impressive. The first thing that strikes you when you enter this muddy, reopened section of closed-down Camp Kilmer is the youth and alertness of these people. There's none of the hang-dog look you usually associate with refugees—so little, in fact, that the term "refugee" somehow seems a misnomer. These people are not unskilled laborers, as a lot of people who have come down here looking for cheap workers and domestic help have found out. Nearly 90% of them are young single men, and about 60% of them are skilled workers from Hungary's metalworking industries, including virtually every trade from lathe operator to plant executives and mechanical engineers.

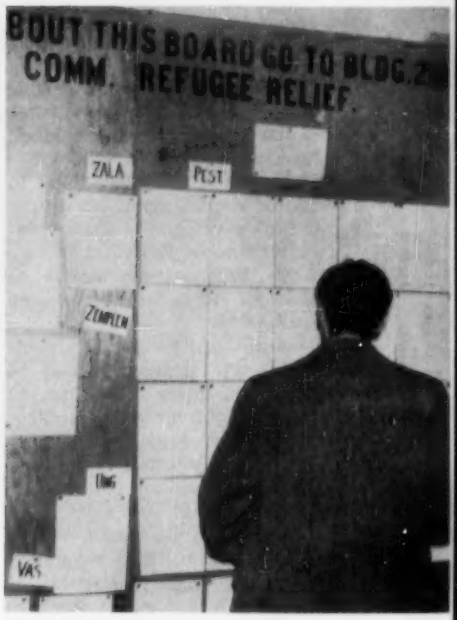
Take the passenger manifest of a planeload of 70 people that's just landed at McGuire Air Force Base. It includes five plant electricians, three machinists, a mechanical engineer, a machine-tool maintenance man, a lathe operator, an engine fitter, an apprentice, a radio technician, a watchmaker, and several technical college students, along with an oddly assorted group that includes several children and housewives, a geologist and an actor.

This planeload, in fact, is a little below par as far as its quota of metalworking people goes. The first planeload to land in the United States included among its 75 people six engineers, four machinists, three maintenance mechanics, four electricians, two electro-platers, three welders, one draftsman, three auto mechanics and a watchmaker—along with a wrestler, a ballet dancer and an operatic tenor. Only four common laborers were listed out of 75 people.

"These are just the kind of men American industry needs badly today. Give them a year or so to pick up our language and to get used to our ways and you'll find them a tremendous contribution to our workforce," Fred Schoenborn, chief of the U S Employment Service's Labor Clearance and Immigration Division, told us. He's down here with a hurriedly recruited staff of Hungarian-speaking interviewers and office workers. Their job is to screen the refugees for job skills, and every last one of them is caught up in a tremendous wave of enthusiasm for the Freedom Fighters They, like the many religious and social welfare organizations that share the same crowded, overheated Army barrack, are forgetting that a clock exists in their efforts to get the Hungarian refugees established in the United States as fast as possible.

"What can an employer do if he wants to hire one of these Hungarians?" we asked Fred Schoenborn. "Frankly, I wish I knew at the moment," he told us, "As you can see just by looking around you, we're in

Some are better off than others . . .
like this automotive mechanic shown holding his three-months'-old child while his wife finishes her first meal in the United States. Secret police came after him when he took part in a riot in Tatabanya, so he fled to the border with his wife and child, walked across in broad daylight carrying the baby. He is one of the few who has no fear of reprisals against his family



Welding engineer . . .
eagerly scans bulletin board for news of friend who escaped with him. He's 24, acquired his M.E. just a year ago. Working in a materials handling and agricultural equipment plant, he told his workers to arm themselves and get into the fight—and had to flee when the secret police came after him.

to US Metalworking

a complete state of flux. We had to set up office here in a hurry, and so have the social organizations in this building. Trouble is, we overlap each other's functions and things are getting worse. Why, around five hundred people are pouring in here a day and here at Camp Kilmer we have to feed them, house them, give them medical care and provide recreation. So far, all the ones who have landed are sponsored people who supposedly have someone to take care of them when they leave here but by far the biggest group—15,000 or so—will arrive here as paroled refugees, meaning that the government, or specifically the Attorney General, will be responsible for their welfare until they find work and homes."

Right now, USES's job is to provide a quick occupational screening for the government and the Immigration Department. Soon, with Presidential approval, USES hopes to set up a two-way funnel to all its branches throughout the country. The local offices will receive requests for workers from employers, send the information to USES at Camp Kilmer, where men will be matched to the job and sent out.

"Until we really get organized with direction from the White House itself, we suggest that a prospective employer get in touch with local USES offices and with social and religious groups if you want to employ a Hungarian." *Don't*, repeat, *don't* come in person to Camp Kilmer for them. The sentiment is echoed by the participating religious and social groups who have brought the refugees in by plane from Europe—Catholic Relief Services, Church World Service, International Rescue Committee, Lutheran Refugee Service, Tolstoy Foundation, United HIAS Service, Hungarian League, International Committee for European Migration, and United Ukranian-American Relief Committee. If you can't get in touch locally with representatives of these organizations, all of them have New York offices, or very probably your local Red Cross branch can help you out.

What kind of people are the Freedom fighters? How much do they know technically by American standards? With the aid of an interpreter, we took this sampling:

N J, 30 years old, is an instrument maker. Before World War II, he

Music to his ears . . .
No matter how dimly we American grownups may view the current Rock 'n Roll craze, it's the music of freedom to jazz-hungry Hungarians. "You have no idea how hungry we are for cheerful music," this fellow told us, "Ever since the Russians took us over, our radio is filled with propaganda and dreary Russian music. We Hungarians are a gay people, and we like gay music like this Rock and Roll."

NEWS REPORT

HUNGARIANS (continued)
completed three years of a five-year apprenticeship at Hungary's Gamma Instrument Plant. When the war ended, the Russians walked in and completely dismantled the plant and took it to Russia. He didn't leave his job—the job left him. Then N J went to work as an instrument maker in the Hungarian government optical instrument plant in Budapest, where his work involved tolerances to ±0.000080 in. He eventually became an inspector.

Six months ago he began attending a special technical school in Budapest. On October 23 he reported for classes, found the entire student body was out on a political demonstration, promptly joined them. That peaceful demonstration evolved into the first bloody riot that touched off the revolution against Russia. He was forced to flee from the secret police, crossing the border into Austria.

"I am very eager to get work in America as an instrument maker," he told us, "because I speak a little English and have had some of the finest technical training in the world, I believe I can learn American methods very quickly. I will go anywhere to get such work—the sooner the better."

We found 24-year-old P P, a welding engineer, eagerly scanning the bulletin board for news of a friend who had escaped with him (see photo on page 107). One year out of technical college, where he acquired a mechanical engineering degree, he was working as a welding engineer in a plant that makes farm equipment and materials handling equipment under contract to an Egyption project when the riots broke out. He promptly told the men under him to arm themselves and get into the fight for freedom. He was about to do so himself when the secret police came in after him, and he had to flee.

Invents Welding Process

Technically, this young man is exceptionally well qualified. He has written several articles for the technical press on welding, has written operation sheets and set up processes for automatic and hand arc-welding of iron and steel, and he has been working on a thermit-welding process which he hopes to perfect and patent here. He would like to work for a firm that will allow him to complete his research, either as part of his job, or on his own time.

We talked to still another mechanical engineer, Gildo Prosen, who unlike the others doesn't mind giving his name because he brought his wife and child out with him and has no fear of Russian reprisals. Gildo's case is exceptional—he has an uncle who is a prosperous Chicago plumbing contractor, who has promised Gildo a job, a home and a car. He deserves a break, after spending five years in prison for trying to fly a plane to freedom from Yugoslavia—and making the mistake of setting down in Communist-dominated Hungary.

But his case is exceptional. Few other of the Freedom Fighters have a setup like that to go to. Most of them are young men without relatives or friends in this country, with nothing but the clothes on their backs—and most of those donated by refugee relief units. They must remain anonymous, and most of them have at least learned to say "Please, no photographs!" in English. They have left everything behind them in the cause of freedom.

Yet they remain quick, intelligent and cheerful. To them, the mud, the austerity and the confusion at Camp Kilmer are things of beauty, for this is the gateway to the land of promise. They are men of oftentimes exceptional skill; they are accustomed to working tremendously hard for little reward. They are, as USES's Fred Schoenborn put it, "potentially a tremendous contribution to our workforce, and once American industry realizes this, virtually every plant in the country will be battling over them."

U S Must Step Up Technical Training, Congress Told

WASHINGTON—The nation faces a possible technological recession unless training programs are activated immediately to provide the skilled manpower required for national defense and the continued growth of our economy, Robert T Sheen, 1955-56 president of the Instrument Society of America, testified on Dec 12.

Keynoting a hearing before the Congressional Sub-Committee on Economic Stabilization of the Joint Committee on the Economic Report, chaired by Representative Wright Patman (D), Texas, Mr Sheen spoke as representative of 10,000 ISA members who create, manufacture, and use complex instruments.

Four major needs cited by Mr Sheen include: education-training of the *current* work force; steady influx of science and engineering graduates into industry; increased worker efficiency through instrumentation-automation devices, and a better communications system on instrumentation techniques to enhance worker effectiveness.

To overcome the predicted technological slowdown, Mr Sheen said the ISA proposes that "engineering extension services" similar to the land-grant colleges' agricultural extension programs be inaugurated and that existing technical institutes quickly should expand their training programs. Also, more vocational high schools should train "instrument mechanics" in the same sense that they now train plumbers, carpenters, electricians, and printers. One answer to the shortage of engineers is to train a greater number of technicians.

"Putting its money where its mouth is," the ISA has allocated $50,000 to form the *Foundation for Instrumentation Education and Research*, set up in September. Mr Sheen described its purpose as "catalytic and conceptional" to stimulate, organize, and promote technical and educational programs at all levels. It is hoped that other organizations, companies, and individuals will contribute to the program.

Seven possible ways to meet the technological needs of tomorrow include: (1) Better trained high-school teachers and more basic scientific courses; (2) vocational training for "instrument mechanics" and technicians; (3) engineering extension services; (4) better use of military training periods, better coordination with civilian needs; (5) expanded work of National Science Foundation and the new ISA-sponsored Foundation for Instrumentation Education and Research; (6) creation of a national instrumentation information center; (7) better liaison between industry and the military.

And, to activate these recommendations, creation of a "task force" commission consisting of private industry and government organizations concerned with the problem.

FIELD REPORT

NEWS REPORT

US Business Looks at 1957

"Mild, Cautious Optimism" Is the Watchword

NEW YORK—While U S industries almost without exception are anticipating another boom year in 1957, this outlook must be tempered by unrest in Europe and the Middle East. That is the opinion of Emerson P Schmidt, Director of Economic Research for the U S Chamber of Commerce, given at the Chamber's annual Business Forecast Symposium December 6. Mr Schmidt called for "a guarded look ahead"—cautioning against over-optimism resulting from 1956's all-time record employment, production and earnings.

Nevertheless, 1956's strong close should carry well over into 1957, and the consensus is that 1957 will wind up slightly ahead of record 1956 with a Gross National Product somewhere between $425-$435 billion against 1956's $417 billion.

But, because this is the third year of a recovery phase that began in 1954, certain stresses and strains may develop in the economy, with some segments showing definite signs of leveling off. The prime reason for this, according to the Chamber of Commerce, is that the nation has been trying to do too much—to expand industry too fast, to build too many houses at once. This has resulted in the government's tight money policy, designed to slow down the economy to a point where economic growth, high employment and economic stability do not outstrip each other.

One industry which will feel the impact of tight money is construction, which rang up $44 billion sales in 1956 as against $43 billion in 1955. Nevertheless, because of a tremendous anticipated plant and equipment expansion, industry officials estimate that 1957 will show a further expansion of 5 to 6%—although part of that may be due to price increases. Residential construction has already begun to show a decrease, with 1956 housing starts down about 16% from 1955, and no signs of 1957 increasing that figure.

In spite of a cost-price squeeze on the farmer, the agricultural implement business expects to do better in 1957—mainly because it is working off excess inventories. And the farmers who have held off purchasing new equipment for the last few years must make replacements soon.

The Suez crisis will have far-reaching effects on foreign trade. For example, blocking of the Suez Canal has cut off about three fourths of Europe's oil supply. This in turn means that much oil heat must be replaced by coal. Thus U S oil and coal exports will rise, and we must build more tankers and freighters to carry them. Such ships require steel plate, adding to the scarcity of that commodity all over the world. Not only that, the war scare is stepping up military programs of many nations, adding to the pressures on the world's metal supplies.

On the domestic front:

• **Automotive sales** are expected to run about midway between 1955 and 1956 levels—about 6.5 million cars. But the achievement of this figure depends upon the effects of tightening installment credit.

• **Appliances:** the home laundry appliance industry, which chalked up record sales of 6,227,000 washers, dryers and ironers—a 9% increase over 1955—expects to hang up yet another record in 1957, of somewhere around 6,425,000 units.

• **Investment castings:** officials of this industry, which outsold its 1955 total of $135 million by more than $25 million in 1956, expect 1957 and 1958 to kick off spectacular gains for the industry, when investment castings will have gained wider and wider acceptance.

• **Commercial heat treating:** The Metal Treating Institute reports that its 1956 business ran anywhere from 25 to 42% ahead of 1955, depending upon locality, and that it expects to maintain or better this level in 1957.

• **Materials handling equipment:** This industry chalked up an all-time record in 1956, running nearly 20% ahead of its 1955 bookings, and the Material Handling Institute expects another 10% boost in 1957.

• **Industrial fasteners:** Russell, Burdsall & Ward's Harry O McCully says that fourth quarter 1956 sales brought the year's total 3% above 1955's, and that current record-breaking sales levels are expected to continue at least through first half 1957. Another maker of industrial and aircraft fasteners, Standard Pressed Steel Co, in 1956 for the second consecutive year topped its previous year's sales by 25%, expects to increase sales by another 20% in 1957.

• **Earthmoving equipment:** Sherman Products Inc, maker of tractor-powered earthmoving machinery, anticipates the industry's 1957 should increase nearly one-third over 1956—to $60 million.

• **Capital goods:** U S industry and commerce will spend 11% more for plant and equipment in 1957 than it did in 1956 (*AM* Dec 17/56 p154) for a total outlay of $40.2 billion, according to a McGraw-Hill Economics Dept survey. And 1958's outlay, according to preliminary plans of surveyed firms, will top that.

• **Aluminum:** In spite of second half 1956 losses because of strikes, primary aluminum output for the year topped 1955 output by 7.5% for a total of 3.365-billion lbs—the fifth year in succession that production set new records.

• **Titanium:** While prices declined sharply in 1956, output soared to record highs. Output for the year of mill shapes totaled 10.6-million lbs, about 25% ahead of 1955, value of $130 million. Already-heavy capital equipment commitments, according to Titanium Metals Corp of America, should more than double 1956 output in 1957.

That is a random sampling of industry outlooks for 1957—almost without exception, they anticipate more business in the coming year. But the U S Chamber of Commerce advocates "mild, cautious optimism" in predicting business trends for the coming year—too many factors could upset the applecart of rising prosperity: the crises in Europe and the Middle East, and a possibility that the government's tightening money policy could (1) fail to hold down soaring prices, and (2) generate hardships and unemployment in certain key industries.

Nevertheless, the basic foundations of continuing prosperity—population growth, new product development and research, and consumer incomes—guarantee that 1957 will be at least a "good" year for U S business, possibly a "great" year.

FIELD REPORT

communications system on instru-

nical and educational programs at all

dustry and government organizations concerned with the problem.

FIELD REPORT

3D Harness Takes 3D Fixture

SAN CARLOS, CALIF: Complex harness assemblies for switching setups are made on a series of boards that can be built up as work progresses. Here at Lenkurt Electric Co are two examples. In each case, the base board is bolted to a Wilton swivel fixture, and boards are of plywood. Some wire is precut and prestripped, but long runs are taken directly from adjacent reels or racks

Midwest...

Sheffield to Combine With Bendix Aviation

DAYTON, OHIO — Sheffield Corp, Dayton manufacturer of precision gaging and measuring instruments and controls, will become a wholly owned subsidiary of Bendix Aviation Corp in exchange for some 230,000 shares of Bendix common stock (valued at approximately $14 million on today's market). Sheffield, however, will retain its corporate name and management as an intact unit.

According to Sheffield's president Louis Polk, who will also become a director, vice president and group executive of Bendix and a member of its Administration Committee, Sheffield chose to merge with Bendix "in order to equip our organization with the greatly expanded facilities, engineering, management, production and financial resources we must have in order to meet the largest projected growth opportunities in our history, and to serve our present and potential customers more efficiently."

Sheffield, which started with several small tool and gage shops, has in the last 16 years increased its sales to a current annual shipment rate of nearly $24 million. The company is today a recognized leader in the manufacture of scientific measuring instruments and controls, high-precision special machines, tools, assembly and inspection systems.

Midwest jottings . . .

Ex-Cell-O Corp, Detroit, has acquired two firms: **Cadillac Gage Co,** Roseville, Mich, producer of plug and ring gages, servo-valve mechanisms, and a fire control system for Army tanks; and **Smith Bearing Co,** Trenton, Mich, manufacturer of anti-friction needle bearings . . . **Studebaker-Packard** has begun production of 1957 Packard Clippers in South Bend. Framing and body work started Dec 19, with pilot models scheduled to come off final assembly lines the following week. Sedans will be the first off production lines, four-door station wagons will follow in the first week of January . . . **A&C Engineering Co,** Hazel Park, Mich, maker of Hydra-Lock line of arbors and chucks, has bought a new plant in Van Dyke, Mich; it'll triple manufacturing space . . . Investment casting industry sales for 1956 are estimated at $160 million, according to Frank W Glaser, executive vice president of **Alloy Precision Castings Co,** Cleveland. Sales for 1955 amounted to $135 million. Big producers are thinking in terms of doubling or tripling plant capacities . . . **Federal-Mogul-Bower Bearings,** Detroit, has more than doubled its dollar volume of automatic transmission parts during the past two years. Firm supplies 65 different kinds of bushings and thrust washers for automatic transmissions; these sales make up 15% of total volume . . . Third annual **Midwest Welding Conference** will be held Jan 30-31 at the Illinois Tech Chemistry Bldg, Chicago. Meeting is sponsored by Armour Research Foundation, and the American Welding Society's Chicago section . . . **Pullman-Standard Car Manufacturing Co's** Chicago plant has just about shut down. All passenger car manufacturing is being handled by the Worcester, Mass, facility. Company can't operate both plants with the low rate of orders being received . . . If **Bethlehem Steel's** bid to acquire **Youngstown Sheet & Tube** goes through, it'll have plants and mills with annual capacity of 2,700,000 ingot tons, and 11,500 employees in the Chicago area. Currently, Bethle-

FIELD REPORT

ing off excess inventories. And the farmers who have held off purchas-

tinue at least through first half 1957. Another maker of industrial and air-

at least a "good" year for U S business, possibly a "great" year.

FIELD REPORT

hem is the only major steel producer without a Chicago area plant . . . Reassuring note: **Crawford Door Co,** nation's largest producer of garage doors, advises that the 1957 market will be about the same as it was in 1956 . . . Merger of **Bingham-Herbrand Corp** of Toledo and Fremont, Ohio, into **Van Norman Industries,** New York, has been completed.

East...

Bullard Acquires Hydra-Feed Lathes

BRIDGEPORT, CONN—The Hydra-Feed line of automatic and tracer-controlled lathes has been purchased by the Bullard Co from Hydra-Feed Machine Tool Corp of South Norwalk, Conn, and Detroit. The transaction involved an undisclosed cash figure and became effective December 11. Bullard took over all the assets and business of the Hydra-Feed company relating to its lathes, including designs and patents. The Hydra-Feed company plans to liquidate in 1957.

The new line of lathes will broaden further Bullard's products which include single-spindle vertical turret lathes manually or automatically controlled, automatic mutiple-spindle vertical chucking lathes, and horizontal boring, drilling and milling machines. Bullard expects to build the new line of lathes at its local plant and to sell the machines through its own sales organization.

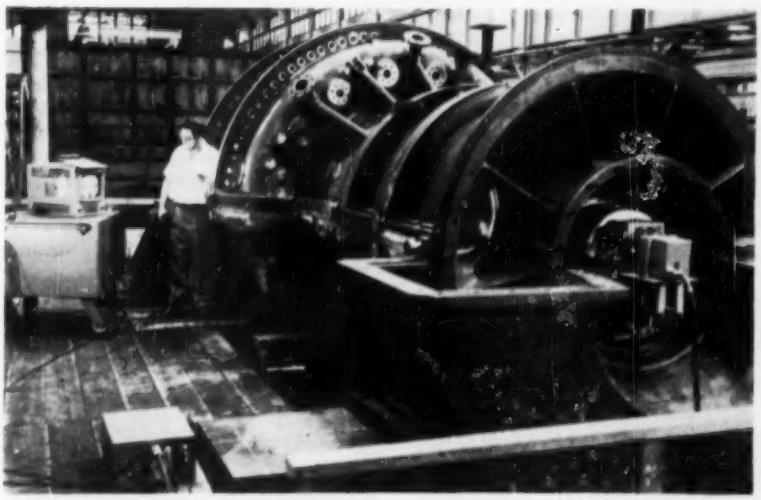
Eastern newsnotes . . .

Bethlehem Steel's $55-million order for three supertankers for Onassis shipping interests will be fulfilled at the company's yards at Quincy, Mass. The 100,000-ton tanker will be the biggest yet built in this country; other two are 46,000-ton each . . . **Kennametal Inc** has started full-scale production in its new plant near Latrobe, Penna; 24,000 sq-ft-facility, employing 100, houses special products grinding department . . . **Norton Co,** Worcester, Mass, has announced increase of approximately 10% in allowance paid for diamonds reclaimed from grinding swarf and wheel stubs returned for salvage; this adds up to $2 per carat . . . Tooling for production of **Pratt & Whitney Aircraft's** new medium sized J-52 jet-turbine engine is in the works; first installation is scheduled for a current production model of a Navy high-speed attack bomber . . . **Air Reduction Sales Co,** NY, has acquired **Jackson Products,** Detroit manufacturer of welding supplies . . . **General Electric,** Syracuse, has a $16.6-million AF contract to produce radar systems . . . **RCA's** defense electronics products facilities at Camden, NJ, will fulfill a $7.8-million order for major subassemblies for airborne radio-receiver sets, power supplies, and data . . . **Crucible Steel Co of America** has moved its Spring Division sales headquarters from New York City to Pittsburgh . . . **Pittsburgh Screw & Bolt Corp** will move three production plants from Pittsburgh to Westmoreland County where it has purchased 75 acres . . . **Lukens Steel Co** claims it has broken a major cost barrier on the way to broadening use of titanium. They're producing solid titanium heads by spinning, instead of using costly dies and stamping equipment . . . **General Motors' Allison Division** has an AF contract for $5,753,237 to overhaul J-35 engines . . . **US Steel's** Pittsburgh district plants have been tuned up to add 670,000 ingot tons to steelmaking capacity. Expansion and improvement of facilities will raise yearly output of Monongahela Valley plants to about 11,910,000 tons . . . **Carrier Corp** plans capital expenditures of $30 million during the next two or three years. Some $10 million is earmarked for research, production, and administration in Syracuse, another $6.5 million will go towards a new plant on the Pacific Coast . . . **DuPont** has announced reduction of 25¢ per lb on top-grade titanium metal sponge.

South...

Around the South . . .

Norton Co has opened its new electric furnace plant at Huntsville, Ala; it'll manufacture boron carbide and electrically fused materials including zirconia, magnesium oxide, and alumina, may add facilities for making aluminum oxide and silicon carbide later. Present investment in land (195 acres) and facilities is $2,250,000 . . . **Lockheed Aircraft's** Georgia Division at Marietta has a $6-million contract for modification



Closed-Circuit TV Aids Turbine Section Positioning

SCHENECTADY, N Y: Using a GE Intratel closed-circuit TV camera, an operator at General Electric's Gas Turbine Dept here positions a 4- to 5-ton gas turbine section—an operation previously accomplished by stretching a taut wire through the turbine and guessing when shells were in position. Camera is bolted, leveled and centered on the first or master shell. When another shell is to be attached, a target is centered in the new shell and the camera focused to the known distance to the target. Then, by watching the monitor 15 ft from the camera, operator notes where target lies in relation to camera lens, thus permitting alignment and adjustment of connecting bolts

present and potential customers more efficiently."

Van Dyke, Mich; it'll triple manufacturing space . . . Investment cast-

got tons, and 11,500 employees in the Chicago area. Currently, Bethle-

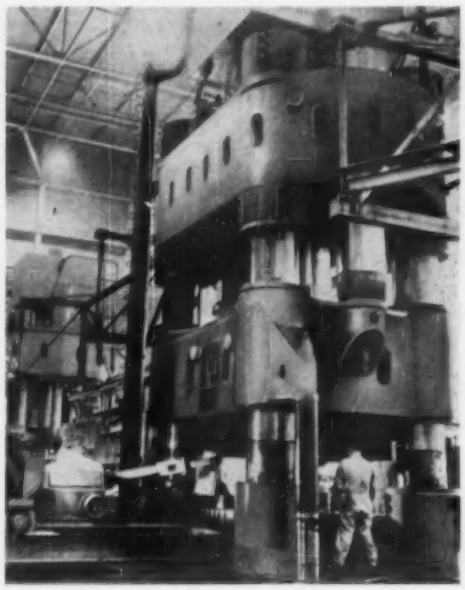
FIELD REPORT

of B-47 bombers . . . **General Electric** has broken ground for its new small appliance motor plant at Murfreesboro, Tenn . . . **James Steel & Tube Co,** Madison Heights, Mich, will open an electric weld tubing and tubular products plant in Miami . . . **Douglas Aircraft's** Charlotte (NC) Division is about to go into production of the Hercules, new member of the Nike guided missile family; division is presently manufacturing the Ajax missile . . . **Youngstown Manufacturing, Inc,** will begin full-scale operation of its recently acquired plant in Louisburg, NC, Jan 1. Expansion doubles Youngstown's production facilities, upping extrusion and smelting capacity to 2 million lb of aluminum monthly . . . **Dow Chemical Co** has started construction of its $11-million power plant at Plaquemine, La; it's part of company's $50-million project, scheduled for 1958 completion, in Iberville and West Baton Rouge Parishes . . . **Piper Bros Plow Works,** Collierville, Tenn, will put up a manufacturing plant and office facilities at Memphis. Unit will make steel trailer beds for farm use . . . **Singer Sewing Machine** has opened a 27,000-sq-ft southeastern sales and service plant in Atlanta . . . Also in Atlanta: **Howard Bros Co** will manufacture textile machinery in a new $100,000 plant . . . **Martin Sprocket & Gear Co** has begun metalworking operations . . . **Atlanta Paper Co,** manufacturer of packaging products and machinery, has merged with the **Mead Corp** of Dayton, Ohio; it'll be operated as a Mead subsidiary . . . **Comer Machinery Co** has purchased the year-old **Darlington Manufacturing Co's** plant at auction, plans re-sale of facilities located at Darlington, SC, has no takers as yet . . . **Production Plating Co,** Adel, Ga, has added 12,000 sq ft of space to house an anodizing unit . . . **Lerio Corp,** maker of sheet metal products, is moving its Mobile, Ala, operation to Chickasaw. Company also has expansion plans in Hattiesburg, Miss, and Valdosta, Ga . . . **Glasspar Co** of Calif has completed an 11,500-sq-ft expansion of its Nashville, Tenn plant . . . **Stumb Metal Products Corp,** new Nashville outfit, has started manufacture of shelving and parts bins . . . **Tennessee Products & Chemical Corp** has shipped the first carload of ferro-alloys from its Roane electric furnace plant at Rockwood, Tenn . . . **American Metals Products Co,** Union City, Tenn, maker of auto seats, has expanded.

West . . .

Western briefs . . .

San Francisco Chamber of Commerce is making a survey of out-of-state products bought by Northern California manufacturers that could be made locally. Questionnaire sent to 3000 industrialists asks them to list their requirements for parts, equipment, and supplies that could be, and aren't, manufactured in Calif. List should be useful to new industries . . . Aircraft employment in San Diego has reached its highest peak since World War II, may break the March 1943 record as result of expanding production. **Convair** plans to take on 2000 more production workers in the next few weeks, upping employment figure 12,000 over total of Nov 15, '55. **Rohr** is up 1208, **Ryan** up 982, **Solar** up 636 over same time last year . . . **Hall-Scott, Inc,** Berkeley, Calif, has put through a general price reduction on all standard models of its bus, fire, truck, and industrial engines. Decrease ranges from $176 to $467 . . . **Hughes Aircraft** has agreed to a general wage increase ranging from 7 to 15¢ per hr covering 8900 employees. In addition to cost of living clause inserted in existing contract, agreement calls for a deferred increase of from 6 to 11¢ per hr a year from now . . . **Titanium Fabricators Inc, Burbank,** has a $274,000 contract from **Convair Division** of General Dynamics Corp to turn out missile components . . . **Atomics International,** a division of North American, is working on a six months' study program to determine the engineering, fabrication, and marine installation requirements for a nuclear propulsion plant to power a "super" marine tanker . . . **Sundstrand Aviation-Denver** (a division of Sundstrand Machine Tool Co, Rockford, Ill) is putting up a $250,000 addition to its year-old plant in Denver. Scheduled for Mar 1 completion, facility will be used for research laboratories, drilling and milling departments. Plant's 1268 workers turn hydraulic components for aircraft . . . **Boeing Airplane** may build two plants for its guided missile work instead of the one originally planned. Firm has optioned property near Pleasanton, 20 miles east of Richmond, Calif, location of the former Ford Motor Co assembly plant (already under option) . . .



8000-Ton Forging Press for Harvey

TORRANCE, CALIF: This 8000-ton hydraulic forging press is now in operation at Harvey Aluminum's plant here, making precision forgings for aircraft and missiles, and non-military forgings such as auto and truck wheels. Press is 53 ft high, with 35.5 ft of it above floor level, has a working stroke of 6 ft and a die area of 9 by 6-2/3 ft. Four-column, three-cylinder design permits operation at either 3000 or 8000 lbs pressure

UAT French Airlines has ordered three more DC-8 jet airliners from **Douglas Aircraft;** total is now 118 . . . **Tapered Air Products Corp,** Lynwood, Calif, will provide **Convair Division** of General Dynamics with $400,000 worth of sculptured structural components, including wing skins and doors, for the F-102A supersonic all-weather jet interceptor . . . **Task Corp's** new $200,000 facility in Anaheim, Calif, is in full production. Capacity for fabricating electromechanical and hydrodynamic equipment and instrumentation is increased by 75% . . . **Rohr Aircraft** sales for the first quarter of the current fiscal year were $23 million as compared with $19 for the same period last year. Backlog climbed to $195 million as of Oct 31; last year it was $127 million . . . **Lockheed Aircraft** has a $25-million Navy order for P2V-7 Neptunes; it'll extend Neptune production through 1958.

wheel stubs returned for salvage; this adds up to $2 per carat . . . Tool-

camera, operator notes where target lies in relation to camera lens, thus permitting alignment and adjustment of connecting bolts

Erwin J Kaiser (left), general manager of the Davis Boring Tool Division of Giddings & Lewis Machine Tool Co, has been named staff vice president of the company. **George K Cassady** (center), sales manager of the G&L and Hypro Division, succeeds Mr Kaiser. **Guy E Lingenfelter** (right), assistant sales manager of the division, takes over Mr Cassady's former post

Names in the News . . .

Kempton Dunn, president of American Brake Shoe Co, has been elected chief executive, effective Jan 1. **Wm B Given, Jr,** who held the post, will continue actively as chairman of the board.

James F Jones has been named manager of the Milwaukee Automotive and Railroad Products Divisions of A O Smith Corp. Prior to joining the company last January as assistant manager of the Automotive Division, Mr Jones was vice president in charge of sales in the Special Products Division of American Motors.

Herbert W Fichtner has been appointed sales manager of the Atrax Co, Newington, Conn, manufacturer of carbide tools. He has been associated with Pratt & Whitney Aircraft as a tool buyer for the past five years.

Owen J Roberts has been named press service manager of the Hamilton (Ohio) Division of Baldwin-Lima-Hamilton Corp. Formerly assistant service manager, he will be responsible for service and renewal parts for the firm's mechanical and hydraulic presses at the Hamilton plant and in the field.

Stanley A Johnson has been appointed director of manufacturing of A-P Controls Division, Controls Co of America. A vice president of the corporation, Mr Johnson has been director of purchasing for the past six years.

Richard E Dunning, plant manager of Logo, Inc, Chicago manufacturer of industrial finishes, has been elected vice president, manufacturing.

Henry F Dever, president of Brown Instruments Division of Minneapolis-Honeywell Regulator Co, has been assigned to direct M-H activities in the industrial controls field. He will coordinate engineering and manufacturing operations of the company's seven divisions now active in this field.

Karl C Schmedicke has been appointed manager of manufacturing for Lamson Mobilift Corp, Portland, Ore. He was formerly associated with Lamson Corp, Syracuse, NY, affiliate.

John T McCarley has been appointed manager of the new lift truck manufacturing plant of Yale & Towne Manufacturing Co in San Leandro, Calif. He is now serving as the company's assistant general manager.

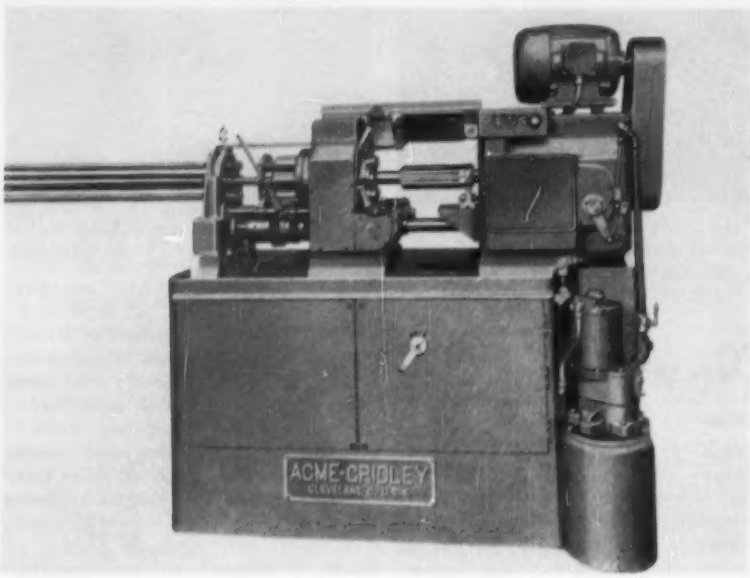
Paul A Benke has been named vice president and general manager of Paasche Airbrush Co, a division of Cline Electric Manufacturing Co, Chicago.

Harry Reichert (left), export manager of Pratt & Whitney Co, Inc, has been named a vice president. **Clinton E Smith,** manager of Kellerflex sales, has been appointed assistant to the general sales manager of the company

A H Schott has been appointed general manager of the Crankshaft and Camshaft Division of Ohio Crankshaft Co. He was formerly factory manager

Rockwood, Tenn . . . **American Metals Products Co**, Union City, Tenn, maker of auto seats, has expanded. . . . or Richmond, Calif, location of the former Ford Motor Co assembly plant (already under option) . . . for P2V-7 Neptunes; it'll extend Neptune production through 1958.

New Shop Equipment,



Small, Fast Bar Automatic Is Added to National Acme Line

Model RA-6 7/16-in. multiple-spindle bar automatic, developed for the manufacture of small, high-production parts, is smallest and fastest member of company's Acme-Gridley line. Included in the special tooling applications are the usual second-operation attachments for threading, reaming, pickup and back-burring, milling, and cross drilling, as in the rest of the line.

Small machine measures approximately 5 ft high, 5½ ft long (16 ft including stock reel), and has working position high enough so that operator can work in erect and comfortable stance. Machine is arranged for spindle speeds up to 4500 rpm in standard models and up to 3200 rpm in models equipped with spindle-stopping mechanism. Although spindle capacity is 7/16 in. with standard collet and pusher tubes, it can be increased to accommodate ⅛-in. round or 7/16-in. hexagonal stock.

Toolslide is of Acme-Gridley flat-surface design with center keyway and parallel T-slots for holding down the hinge-type toolholders that are furnished at each spindle station. Lower cross-slides are of flat type, measuring 4 in. wide by 6 in. long for greater sliding area. Arrangement has been made for independently operated auxiliary side slides in the 2nd and 5th positions; 5th position slide is usually used for cutoff.

Cycle of machine is 0.7 sec at high speed. High-speed segment of the drum shaft will be about 240°, which will allow an idle time of 0.466 sec added to the machining time.

National Acme Co, 170 E 131st St, Cleveland 8, Ohio

Jocar Jig-Grinder Unit Is Used With Horizontal Surface Grinder

Jocar jig-grinder unit, Model JG, is engineered for use with horizontal-spindle surface grinders, and provides all the elements for size control, hole generation, arc angular size and placement control, and power operation of the spindle carrier. Device relies on the surface grinder for axis positioning only. Operating in a horizontal position, unit uses the head and saddle of the surface grinder for arc coordinates and manual table movement for the oscillating action necessary in jig grinding.

Unit was designed to jig-grind regular and irregular hole shapes without the need for a conventional vertical jig-grinding machine or jig-boring machine grinder attachment. Unlike boring-head grinder units, the Jocar unit is designed to generate its own arc with not more than 0.0002 in. total indicator reading runout. It provides 5-in.-ID grinding capacity with 1-in.-dia wheel.

Unit comes in two basic models: all-electric and air-electric where sufficient air volume is available for ½ or ¼-hp operation. A 1/5-hp, 45,000-rpm electric spindle is used on the all-electric model; on the air-electric version, a ¼-½-hp Onsrud spindle gives speeds to 50,000 rpm.

Models fit almost all makes of grinders. They can also be obtained as manually operated jig grinders, equipped with 10 x 15-in. slide movement.

Distributed by Production Machinery Development Co, 4845-49 St Aubin Ave, Detroit 7 Mich

Rogers Knife and Face Grinder Comes in Eleven Sizes

Heavy-duty Series 220 knife and face grinder is made in eleven different sizes between 78 in. and 220 in. Unit is equipped with an oversize enclosed, ball-bearing wheelhead spindle. A 25-hp motor drives the wheelhead.

Machine is available with 3 sizes of segmental grinding wheels: 20, 26, and 30 in. It is equipped with hydraulic table drive with table speeds from 10 to 100 fpm.

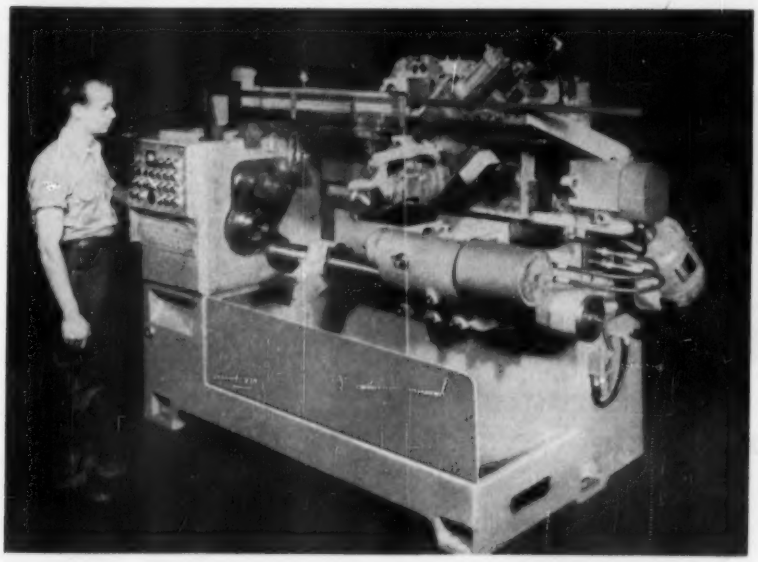
Machine is suitable for grinding shear blades, dies, and machine knives. It is also equipped as a face grinder with slotted table for face work up to 24 in. high and 18 in. wide. The 172-in.-capacity grinder weighs over 12 tons.

Samuel C Rogers & Co, Inc, 2070 Sheridan Dr, Buffalo 23, NY

been appointed assistant to the general sales manager of the company

manager of the Crankshaft and Camshaft Division of Ohio Crankshaft Co. He was formerly factory manager

Materials and Parts . . .



Sundstrand Tracer Lathe Speeds Machining of Irregular Shapes

Model 14T multi-cycle tracer lathe requires only one templet, easily accessible from front of machine, for multi-cycle cuts. Two ruffing cuts, a semi-finish cut, and a finish cut may be obtained in one automatic cycle. An indexing tool turret permits use of two cutting tools, one for ruffing and one for finishing. Shoulder-facing tools can be provided for such operations as squaring.

Stylus, templet, and work are in full view of operator. Front loading lends itself to easy handling, and is well suited for automatic handling mechanism if desired. With tracer controls and stylus on the top carriage, chips and dirt will not accumulate on templet.

Transmission head is available in 2, 4, or 8-speed type. Automatic speed changes are provided for all cuts of a cycle with each head. A direct-reading scale is provided for positioning the tailstock. All controls are within reach of operator.

Sundstrand Machine Tool Co, Rockford, Ill

Contour and Surface Projector Is Portable, Self-Contained Unit

Magnavisa for inspection and examination of relatively flat objects and small parts is available in two models; one enlarges three times, the other five.

Part is placed on a two-way movable platform; optical head is lowered into contact, and image is projected onto an illuminated 4½ x 12-in. screen. Weight is 18 lb; overall size, 21⅛ x 13¼ x 13¼ in.; throat opening, 3⅞ in.; price $110.

American Optical, Buffalo 15, NY

...including

MACHINE TOOLS AND ATTACHMENTS

Turret Drill 116
Tracer-Controlled Miller 117
Variable-Speed Bandsaw 117
Automatic Machine Control 118
Rotary Belt Grinder 119
Tapping Head 120
Forming-Cutting Machines 121

TOOLS AND ACCESSORIES

Boring Bar 116
Rotary Table 120
Coiled-Stock Feed 123
Portable Electric Drill 126

FORMING AND CASTING

Hydraulic Extrusion Press 120
Vertical Rolling Mill 121
Giant Shear 122

HEAT-TREATING

Atmosphere-Controlled Furnace 116
Induction-Heating Furnace 122

CLEANING AND FINISHING

Vibrating Parts Washer 118
Vibratory Lapper-Polisher 124
Automatic-Stroke Polisher 126

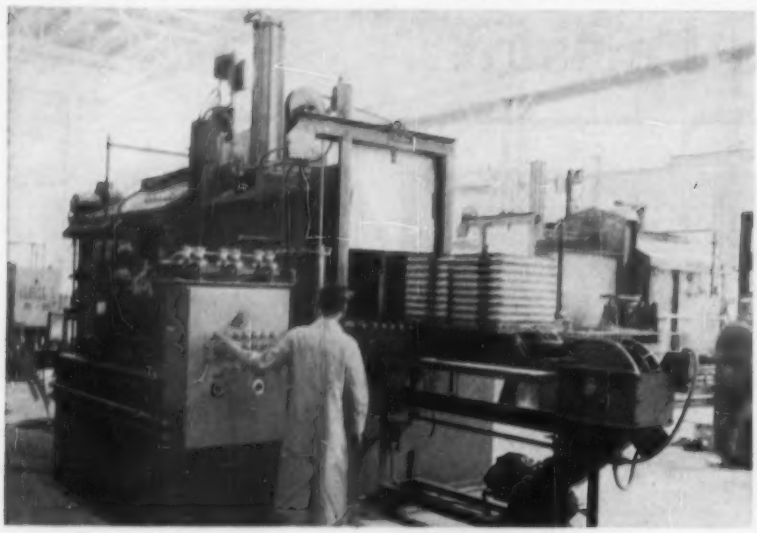
INSPECTION

Cam Gage 117
Ultrasonic Testing Unit 124

PARTS AND MATERIALS

Aluminum-Bronze Alloy 126
Double-Acting Cylinders 134
Bar Stock 136

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS



Surface Combustion Batch Furnace Offers Automatic Work Cycle

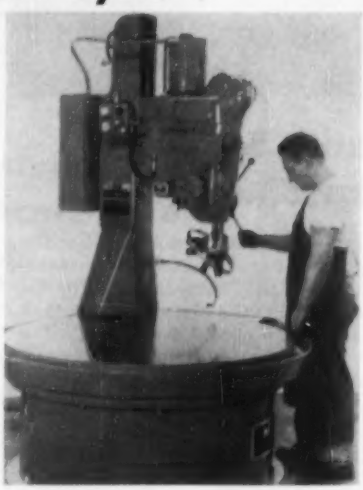
Model called Super has been added to the Allease line of batch atmosphere-controlled furnaces. Latest model offers maximum gross heating rate of 1735 lb per hr, compared with 775 and 1030 lb in other models. Any one of three optional mechanization systems can be applied to each model to assure uniform work quality.

In the completely mechanized Super Allease, operator simply puts work on the charge table, pushes a button, and the work moves automatically through heating cycle, quenching cycle, and discharge. Automatic action makes it possible for one operator to handle several furnaces, each for a different heat treatment and each on a varied cycle. Temperature controls and timers can be preset to metallurgists' specifications.

With an operating range of 1400 to 1750 F, each of the Allease models can perform the following processes: gas carburizing, clean hardening, dry cyaniding (carbonitriding), carbon restoration, homogeneous carburizing, clean annealing, and oil quenching or Mar-quenching.

Heating elements are company's suction-type radiant tubes, gas or oil fired. Forced recirculation of the controlled atmosphere promotes rapid heat transfer and uniform temperature throughout dense loads. Enclosed quench is equipped with circulator and two-level elevator which permits charging the furnace while the previous load is in the quench.

Surface Combustion Corp, 2365 W Dorr St, Toledo 1, Ohio



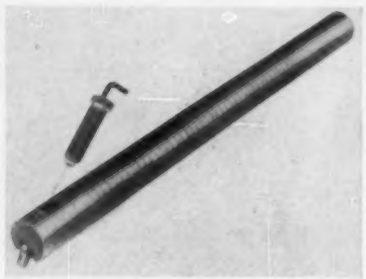
Howe & Fant Turret Drill Machines Large, Circular Patterns

Model A-50 turret drilling machine, which accommodates rotary fixtures up to 48-in. dia, can perform consecutive drilling, reaming, counterboring, and tapping operations in large, circular patterns. Unit is equipped with a complete coolant system, requires a minimum of floor space, and permits operator to work in a conventional position.

Machine turret carries 6 spindles which work on a common axis and are indexed into position as required. Speed, depth, and reversals for tapping are pre-set for each spindle and repeat automatically as the turret is indexed. Work is loaded in a rotary fixture and indexed from one location to another, all necessary operations being performed at each hole location by indexing the turret.

Counter-balanced quill, which carries the turret, provides 6 in. of travel. Head of machine is separately counter-balanced and adjustable through 15 in. of travel to suit job size and operator's convenience.

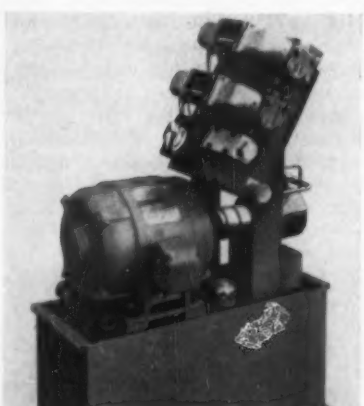
Howe & Fant, Inc, 20 Fitch St, East Norwalk, Conn



Vibration-Proof Boring Bar Has Micrometer Adjustment

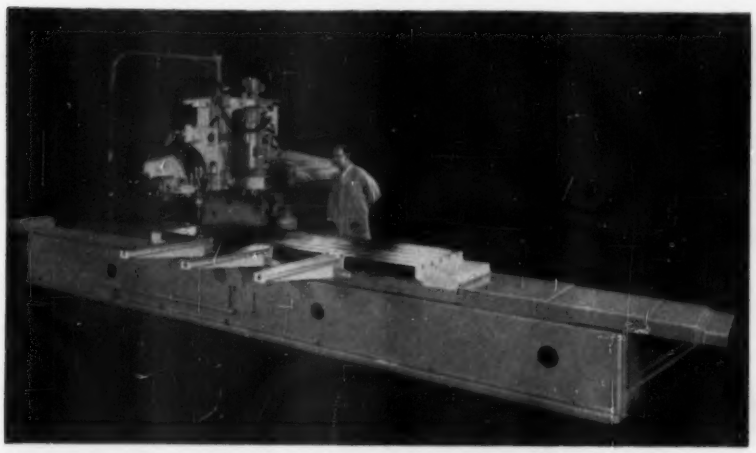
Boring bar said to be vibration proof and chatterless is equipped with a micrometer adjustment to adjust cutting tools in 1000ths. Constructed with shock-absorbent material and special alloy heat-treated steel, boring bar is offered with cutting tool at 53 or 90° angle. Borers are also available with conventional toolbit, which is not adjustable. Bar is graduated every ¼ in. to indicate depth of boring.

Modern Mfg Co, Inc, Edgemont & Clementine Sts, Philadelphia, Penna



FEED AND TRAVERSE POWER UNIT, Model ST-10, has capacity of 5 gpm at 2000 psi. It is comprised of a JIC 10-gal reservoir and fittings, 3-hp electric motor, and a pressure-compensated variable displacement pump and relief valve—*Rosaen Co, 1756 E Nine Mile Rd, Hazel Park, Mich*

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS



Tracer-Controlled Head Machines Aluminum on Rockford Miller

Hydraulic planer-type airframe mill, designed for fast machining of variable and complex shapes, speeds the machining of airframe parts. Machine can be furnished in heights of 30, 36, and 42 in.; widths of 30 and 36 in.; and stroke lengths of 6, 8, or 10 ft. Both bed and table ways have been designed for tracer-milling control; ways are square with suitable hold-down for vertical adjustment and a narrow guide on the column side. Full rated stroke of the machine is available for all lengths.

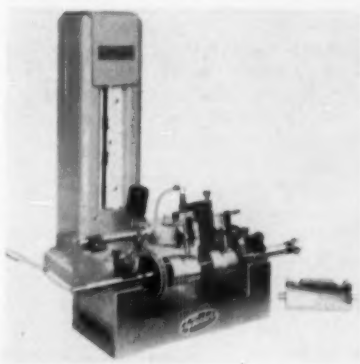
Hydraulic power unit is 7½ hp, and employs tandem-mounted pumps. One is used for cross and longitudinal movements and one for vertical movement. Power unit also includes a heat exchanger with automatic temperature control for maintaining constant oil viscosiy for accurate duplication. A separate 1-hp pumping unit is used to counterbalance the duplicating head and is also used for table lubrication.

The milling head is extra equipment, and is offered in many variations of speed and horsepower. A 3-D tracer is mounted on adjustable slides for longitudinal, cross, and vertical adjustments for varying the relationship between cutter and stylus. An additional tracer valve, arranged with a 4-position turret stop, is provided for variable depth control in 360° contour operations. Selector button on control pendant selects which valve is to be used.

Several accessories are offered for the machine: hardened-and-ground way at top of crossrail; hardened-and-ground ways for bed; sheet-metal telescopic bed and way guards with neoprene wiper strips; table extension bars which provide 36-in. extension along outside edge of table; and spray coolant system for the cutter.

Milling head shown in illustration is 15/30 hp and 1800/3600 rpm. This head is equipped with a No. 50 National taper and draw bar. Spindle is arranged with a Warner electric brake. Head is water cooled and protected with pressure and thermal switches which insure proper cooling.

Rockford Machine Tool Co, Dept S, 2500 Kishwaukee St, Rockford, Ill



Parker Gage Checks Three-Dimensional Cams

3-D Comparitor is designation for cam inspector which, by checking against a master, is said to give readings on both 2-D and 3-D cams accurate to ±0.0002 in. Measurements of ±0.0001 in. are reported possible in highest precision work. Unit also makes possible the complete comparison of any two or three-dimensional cam, giving readings on an infinite number of specified points.

Incorporating a Sheffield air gage, with plunjet, device employs a ball probe to trace work contours. Counterbalance maintains constant pressure on the probe. Master and duplicate cams are installed on a single arbor. As both pieces revolve, any discrepancy of dimensions is indicated on the air gage.

Parker Stamp Works, Inc, 650 Franklin Ave, Hartford, Conn

Tannewitz Variable-Speed Saw Operates at Speeds to 6000 rpm

EV-24 variable-speed bandsaw has wheels of 24-in. diameter and can be operated at any speed from 300 to 6000 rpm. At low speeds it will saw light cast iron, bronze, or cast brass; at intermediate speeds it will saw bronze, yellow brass, aluminum, and magnesium; at higher speeds it reportedly can saw any sheet metal such as steel, brass, or aluminum.

Saw has a 24 x 28-in. table which may be tilted or locked at any angle from 15° left to 45° right. Unit is motor driven and equipped with pushbutton controls and overload and low-voltage protection.

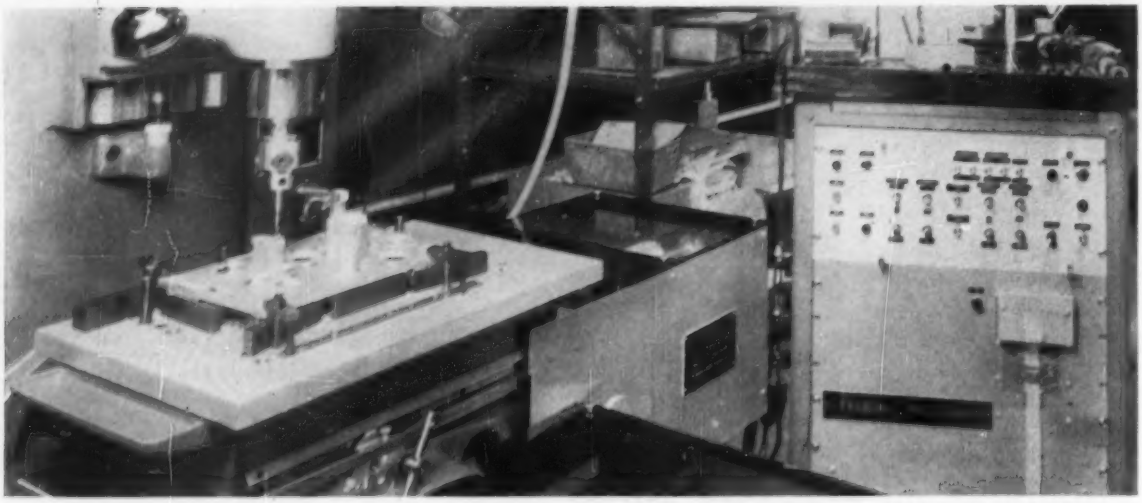
Other features: heavy cast frame; fully enclosed, carefully balanced wheels; quick-acting foot brake; and roller guide supports. Bulletin EV-24.

Tannewitz Works, Grand Rapids, Mich

Iron powder electrode, Speedex Type U, for welding mild and galvanized steels is said to be suitable for use in all welding positions on any type of current at high amperages. Designated AWS Type 6013, it is recommended particularly for structural welding and general maintenance.

Metal & Thermit Corp, 100 Park Ave, New York, NY

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS



Probomat System Automatically Positions Machine Tools

Automatic control unit trademarked Probomat, intended for the precise positioning of machine tools, has been developed by the Warner & Swasey Research Corp. Control is applicable to jig borers, milling and boring machines, and rotary and rectangular positioning tables. It can be applied to rotary as well as linear movements, and is applicable to as many axes or channels as desired. Although the accuracy achieved depends essentially on the machine which the system controls, tolerances of ±0.0001 in. are said to be easily obtainable. The system ordinarily uses ac drive motors, although hydraulic and other drive means are not excluded.

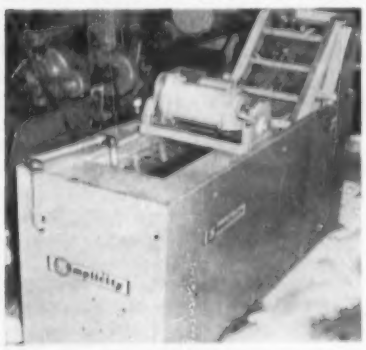
Typical application of the system is jig boring, where the above-mentioned accuracies have been maintained on a Moore No. 2 jig borer (see illustration). Here the system is completely tape-controlled, with the tape controlling the machine dials and setting them to the programmed dimensions. Once a part has been programmed, identical pieces can be made to the same degree of accuracy at any future time.

Setup for operation of the system consists of laying out the program from a drawing. Slide movements are listed in terms of program steps; this information is then punched into a standard 8-channel tape—a tape punch is available as an accessory item—which is placed in a control console. Console can be remotely located.

The tape-controlled system supplements a previously announced system, still available, that is drum-controlled. Here the positioning units, which are attached to the longitudinal and transverse leadscrews, consist of drums that control the distance each slide dial moves. A tape contains information to control such operations as direction of slide movement, fast and slow movement, and table and cross-slide clamping.

Company points out that the system, here used to position tools, can also be applied to positioning measuring probes and transmitting measuring signals in automatic inspection systems. Several of these automatic systems are available.

Warner & Swasey Research Corp, Dept AM, 5¼ W 33rd St, New York 1, NY



Vibrating Parts Washer

Unit designed to clean machined parts can also be used to degrease metal stampings, and as quencher for heat-treated parts.

Washer consists of a basket agitator actuated by an oscillating assembly with two eccentric shafts, a gear-driven flight conveyor to remove parts as they are cleaned, a centrifugal pump, and filter with recleanable cartridge. It uses a ½-hp motor for the agitator and a dual-shaft ½-hp motor to drive conveyor and pump. Agitator rate of feed can be adjusted while machine is operating; conveyor speed can be adjusted by variable pitch pulley.

Simplicity Engineering Co, Durand, Mich

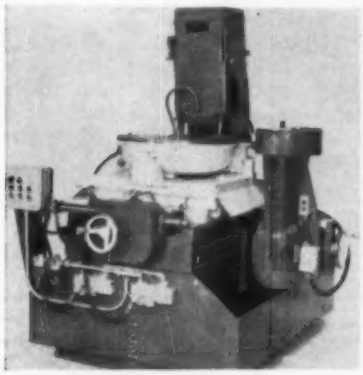
High Nickel Brazing Alloys For High-Temperature Service

Series of four alloys, called Handy Hi-Temp, offer high strength at elevated temperatures, superior resistance to corrosion and oxidation, according to manufacturer. Said to be particularly useful for brazing austenitic stainless, high-nickel heat-resistant and precipitation-hardening alloys, they will also braze carbon steel and non-ferrous metals having melting points above 1850 F. Applications include joining high-temp resistant parts for jet engines and rocket motors, honeycomb structures, heat exchangers, and corrosion-resistant equipment.

They are available as cast rod, powder, resin-bonded sheet, as well as in forms fabricated and sintered from the powder. Flow points are in the range of 1825 and 1925 F. Nickel content ranges to 93%.

Handy & Harman, 82 Fulton St, New York 38, NY

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS



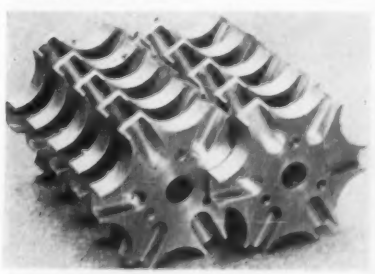
Automatic Rotary Belt Grinder For OD Grinding, Finishing

Platen-type abrasive belt grinder for wet or dry OD grinding of ferrous and non-ferrous metals and other materials handles circular parts from 26 to 40 in. in dia, can be modified to meet other dia ranges.

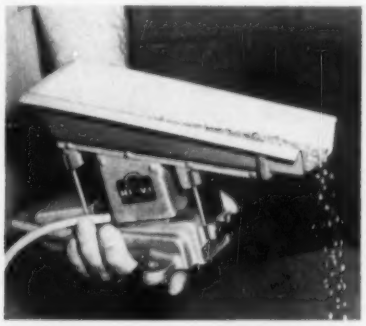
Self-contained motor-driven worktable rotates at standard speeds of ¾ or 3 rpm with optional change gears for other requirements. Air-controlled infeed mechanism carries rotating parts in against the belt, and infeed travel is adjustable with a minimum of 0.0016 ipr. Table is adjustable from 0 to 45° for angular grinding.

Standard abrasive belt size is 8 x 107 in. with belt speed from 2000 to 5000 sfpm, depending on application. Grinder is 70 in. long, 70 in. wide, 76 in. high, and is powered by a 10-hp motor. Worktable height is 47 in.

Engelberg Huller Co, 831 W Fayette St, Syracuse 4, NY



GENEVA MOVEMENTS for converting rotary to intermittent or indexing motion are made with 3, 4, 5, 6, or 8 indexing stations with any hub, bore or keyway combination desired, including ball-bearing mounting. Drives are made with wheel OD from as small as a dime to as large as 20 in. Materials used are mild steel or heat-treated machinery steel—*Genevamatic Engineering Co, 404 E Ellamae, Tampa, Fla*



Tiny Eriez Vibratory Feeder Handles Small Quantities

Miniature electro-permanent magnetic vibratory feeder, Model FE ¼, is designed for extremely accurate feeding operations where relatively small amounts of materials are involved. Model measures only 10¾ x 5 x 6⅛ in., weighs 7 lb. It can be supplied with feeder trays of various types: flat, tubular, half-round, V-shape, and specials.

Small unit is similar in design to larger models in company's Hi-Vi line. It operates directly off an ac line, requiring no source of rectified power. Magnetic system combines an ac electromagnet with an Alnico-V permanent magnet, the resulting forces acting to pull down and then push up and forward on the tray assembly. Changes in feed rate are regulated by a remote control.

Eriez Mfg Co, Erie, Penna

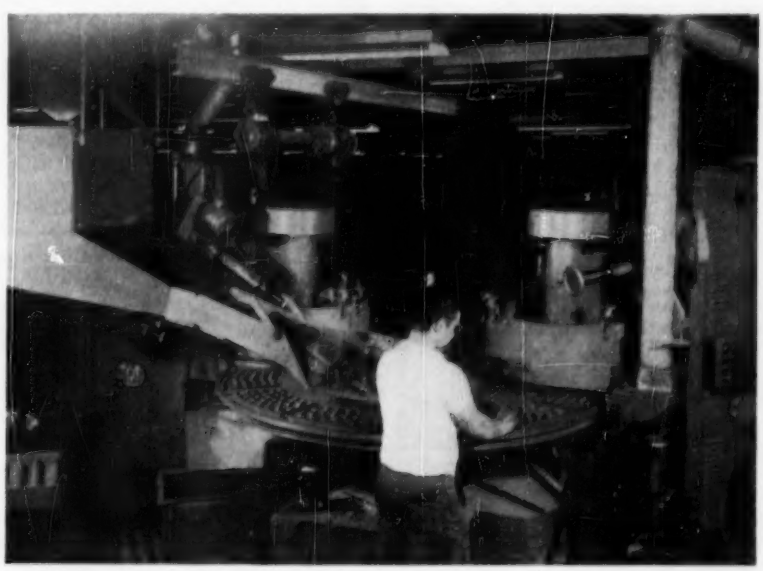
Tracer Control System Fits U S Vertical Miller

The U S vertical milling machine may now be equipped with a tracer attachment for automatic control. A Turchan Follower jackscrew-type knee hydraulic attachment is used, which permits more accurate work, according to company, than raising and lowering the quill during machining operations.

Tracer system controls the vertical rise and fall of the table. It is actuated by a hydraulic cylinder mounted in place of the machine's vertical screw. Cylinder movement is governed by the Turchan tracer valve, working from a model or templet located on machine table. The stylus which governs table's vertical movement is set in the same plane as the milling-machine spindle.

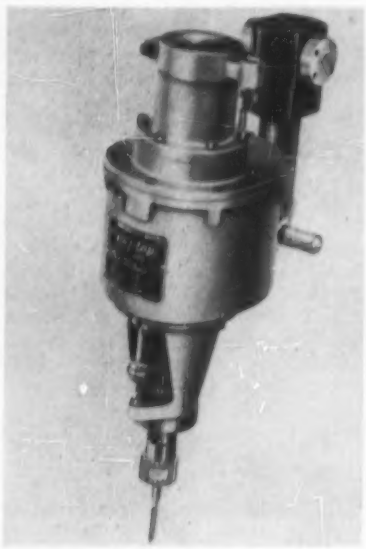
Range and capacity of mill are in no way limited by the automatic control. Under normal machining conditions, depth of cut can be controlled to within ±0.001 in.

U S Burke Machine Tool Div, Cincinnati 9, Ohio



INDUSTRIAL SPRINGS are ground flat on the ends by No. 918-30 special tandem grinder, which employs two pairs of diametrically opposed grinding disks. Capacity ranges from 1- to 2½-in. dia and from 1 to 3 in. long. Springs are fed from hopper into special flat holders on a large feedwheel. As feedwheel rotates, a pair of 30-in. abrasive disks rough-grinds both ends of spring; further along in same rotation, a second pair of disks finish-grinds springs. Unloading is automatic—*Besly-Welles Corp, South Beloit, Ill*

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS

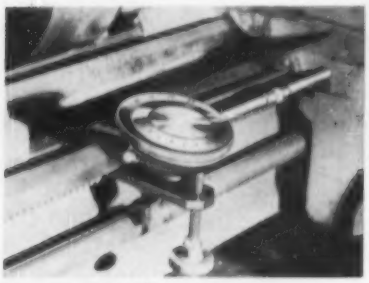


High-Speed Tapping Head Is Fully Automatic

Auto-Tap, a self-contained, lead-screw tapping head unit, operates from a drillpress or a direct motor hook-up. Three-way control box permits finger-tip, foot switch, or remote control for the fully automatic production line.

Unit has an adjustable depth control and reversing mechanism activated by a relay. Built-in activating air motor requires low pressure air and is responsible for the extreme sensitivity of the unit. Model operates on an 8-v transformer connected to a 110-v outlet. Tap range is 0-80 to ¾ - 10, up to 2-in. stroke.

Automatic Methods, Inc, 802 W Grand St, Elizabeth, NJ



Lloyd Vernier Travel Gage Measures Lathe-Carriage Travel

4-in. vernier travel gage provides for the accurate measurement of the carriage travel of lathes with a single set-up for 4 in. or more of travel. With 4-in. extensions, measurements can be made on greater lengths. Device is reported accurate within 0.001 in. in 4 in. of travel, and extension bars are held to accuracies within 0.0005 in. Gage diameter is 4⅛ in. and weight is 2½ lb.

Main application of the device is to eliminate backing the carriage out of the way from work in order to measure the cut on inside or outside steps. It is also reported to be a big time saver for gaging hole depths in deep, difficult places.

Measurements are read similarly to those made with a conventional vernier gage. Graduations are in 0.001-in. steps.

Lloyd Tool Corp, 1620 N Broadway, Burbank, Calif

Small Mico Rotary Table Has 4-in. Diameter

A useful accessory for circular milling, engraving, or graduating, 4-in.-dia table has a ⅜-in.-dia center hole with ⅝-in. counterbore located for the mounting of a workholding stud or clamp. Table top rotates through 360° and has a graduated scale with direct readings to 1° and to one min with vernier.

Weight of the table is 3½ lb, and over-all dimensions are 6¾ x 4⅛ x 1-3/16 in. Assembly has been treated to resist corrosion.

Mico Instrument Co, 80 Trowbridge St, Cambridge, Mass

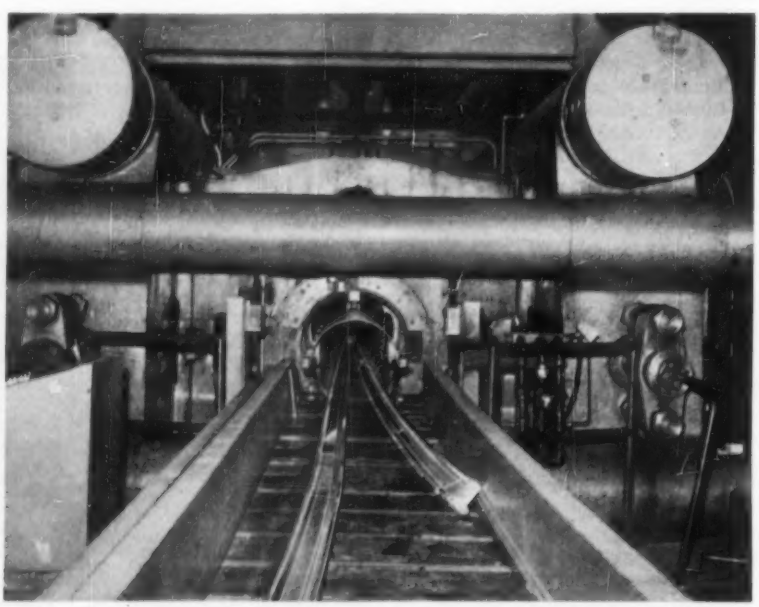
GE Machine-Tool Relay

Six-pole in-line 10-amp relay (NEMA Type A1B) is designed for applications such as machine tools and control panels. Unit increases flexibility and conserves panel space by reducing the number of extra relays necessary in automatic control systems.

Saddle-type terminal permits wiring from four directions with either plain wire or crimped-on terminal connections. Relay is available in both standard and latched-in forms. All terminals are accessible from the front of the unit.

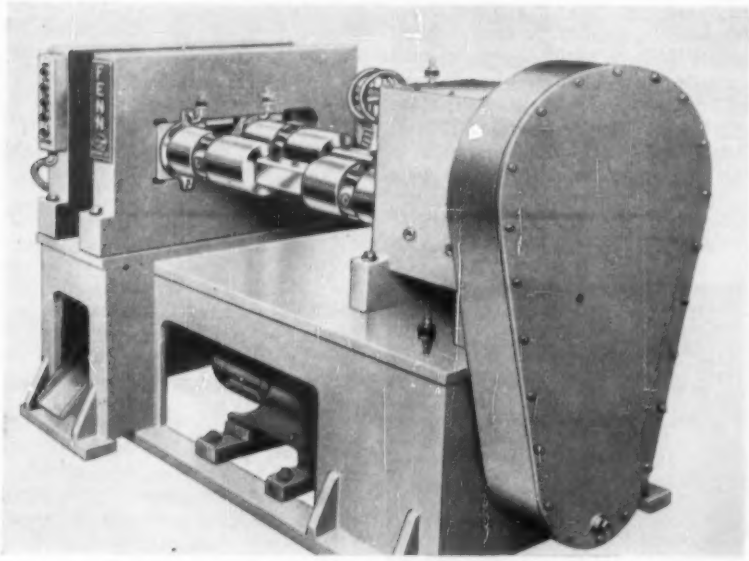
Company claims that relay will maintain a trouble-free average life of 20 million operations under normal conditions. It is available in 2, 3, 4, and 6-pole models and in all voltages and frequencies up to 600 v, 60 c.

General Electric Co, Schenectady 5, NY



AIRCRAFT STRUCTURAL MEMBERS are produced on 126-ft-long hydraulic extrusion press, located at Torrance, Calif, plant of Harvey Aluminum, which can exert pressures up to 8100 tons. Press is operated by one man from a raised platform which permits viewing of complete extrusion cycle. Mechanized runout table is used, with operator riding a special "puller gripper" which provides control for handling the extrusions—*Loewy-Hydropress Div, Baldwin-Lima-Hamilton Corp, Philadelphia, Penna*

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS



Fenn Vertical Rolling Mill Compacts Metal Powders

Designed and built for the progressive compacting of metal powders, No. 061 vertical mill features work rolls in a horizontal plane. Metal powder is fed vertically into the rolls from a hopper located above the roll housings, and a chute arrangement beneath the rolls provides for delivery of the compacted strip for sintering.

Mill is work-roll driven by a heavy-duty universal drive designed to transmit heavy torque loads to the precision-ground 6 x 8-in. rolls. Maximum separating force is 150,000 lb, and a 15-hp Lima 4-speed drive permits rolling speeds from 5 to 30 fpm. Roll drive pinions are continuous cut-tooth herringbone type of special alloy steel, and reduce the possibility of shattering the compact by virtually eliminating gear chatter.

Typical of the materials produced by the mill are refractory metals such as tungsten and tantalum (for which rolling is necessary to produce a finer grain structure) and superhard metals such as cemented carbides (for which rolling is necessary to produce the desired structure). The mill features duplex handwheels for screw-in adjustment, and gear ratios permit manual operation under full load.

Fenn Mfg Co, Newington, Conn

Automatic Forming-Cutoff Machine Offered in Two Types

Two new versions of the Brown & Sharpe No. 00 automatic screw machine are for jobs that do not require reversing the machine spindle. Both machines have the high spindle speed of 10,000 rpm.

Type No. 1 has a turret and vertical slide and is identical with the automatic screw machine except for the non-reversing spindle. It is designed for such operations as drilling, reaming, facing, turning, forming, and cutting off. Turret has 6 holes.

Type No. 2 omits the vertical slide, and the turret is replaced by a one-tool position slide. Machine can be used for form and cutoff work.

Specifications for both machines: max stock capacity, 1-in. diameter; max turning length, 1 in.; 3-hp constant-speed motor; 18 spindle speeds ranging from 630 to 10,000 rpm.

Brown & Sharpe Mfg Co, Providence, RI

Drawing Reproduction Service Utilizes 105-mm Film

Micro-Master service is intended for the storing and reproduction of large engineering and architectural drawings. System utilizes a 105-mm negative, 16 times larger in area than 35-mm microfilm, from which reproductions up to 36 x 54 in. in size can be made.

System, which is based on black and white film, was developed by Micro-Master, Inc, of Kansas City in association with Keuffel & Esser Co, Hoboken, NJ. Equipment to provide a nation-wide reproduction service is being installed in several industrial centers.

System is said to capture the weakest line image on drawings without respect to background dirt. Negatives do not require corrective opaquing and need no artwork except to delete unwanted features of the drawing itself. Process of reproduction is said to remove most of the unwanted marks—dirt, folds, and mends—on the original drawing.

Company reports that in many instances second originals made by the process are superior to the original, because system replaces the carbon-pencil image on the first drawing with darker, sharper silver compound lines without picking up the background deficiencies of the paper base itself. Any number of prints can be made from second original.

Keuffel & Esser Co, Hoboken, NJ

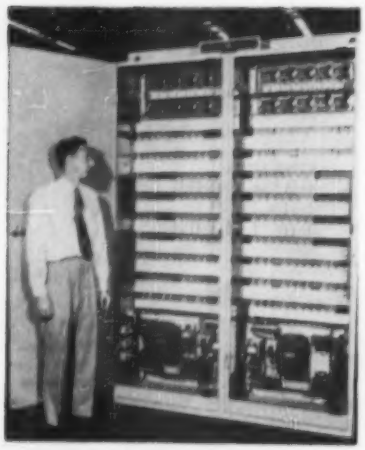
Sheffield Method Converts Air Energy to Electric Energy

Described as the fastest known method for converting compressed-air energy into electrical energy, single-switch "transducer" is reported to accomplish operation in approximately 5 milliseconds. Transducer was developed to improve and speed up company's precision air-gaging and measurement controls for high-speed internal grinders; development is also expected to have widespread applications in the automation of many processes and controls.

Most obvious advantage of the new development is that higher speed of accurate response will provide greater speeds in the operation of production equipment, and that higher gaging rates will be obtainable.

Sheffield Corp, Dayton 1, Ohio

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS



G E Static Switching Control Provides Five Logic Functions

Designed to aid in the automation of various low-power switching operations, static switching control system makes available a line of static components to provide the five logic functions basic to intelligence switching: and, or, not, memory, and time delay. The logic units and their associated circuit components, such as power supplies and output amplifiers, provide a tool with a wide range of applications.

Control can be furnished in component form for use of the control designer or in completely engineered panels and system. Such failure factors as wear, fatigue, and adverse environment are greatly reduced in the system, because devices are encapsulated, have no moving parts, and employ conservatively rated subcomponents.

For easier panel design, construction, and maintenance, system includes plug-in construction, packaged power supplies, built-in wire trough, and color coding. Trouble-shooting can be performed with a standard volt-ohm meter. Monitor lights are also provided for quick checks of proper circuit functioning.

General Electric Co, Schenectady 5, NY

Pilot-Plant Furnaces Are Added to Lindberg Line

Designed to fill the gap between laboratory and production line, a group of furnaces has been developed for pilot-plant operation. With this equipment, manufacturers can determine proper methods and process for heat-treating and melting metals.

Line includes 6 units: an atmosphere box furnace 6 x 12 x 5-in. for continuous operation at 2600 F; box furnace of 5½ x 7½ x 14¼-in. size with reactor control; a 3-kw high-frequency induction furnace; a horizontal-tube furnace; a vertical-tube furnace with effective size of 5-in. OD x 8 in.; and a high-temperature pot furnace for operation to 2500 F. Additional units will be added to the line according to demands from the field.

Lindberg Engineering Co, 2450 W Hubbard St, Chicago 12, Ill

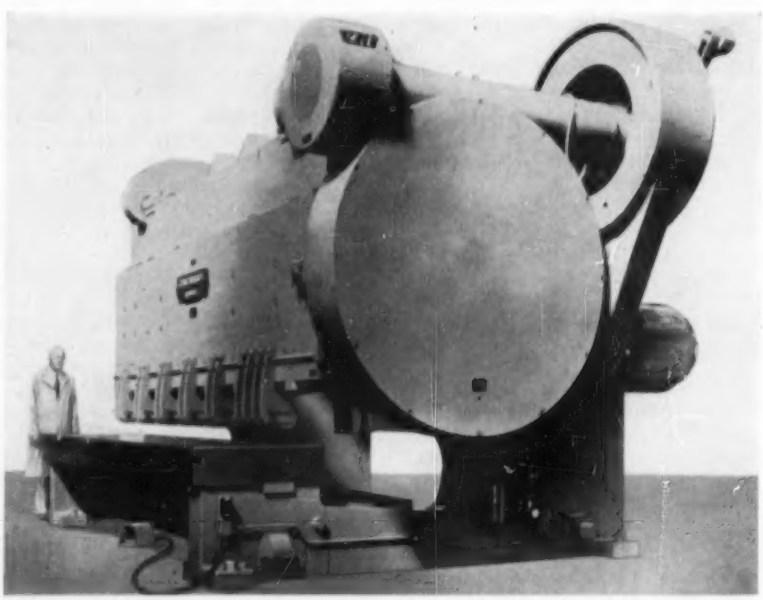
Lindberg Heat-Treating Furnace Uses Induction Heating

Induct-O-Ring is designation for furnace designed for carbonitriding, bright hardening, and carburizing of small parts. Unit is company's first heat-treating furnace to incorporate induction heating principle, which makes possible the elimination of any heating elements, element terminals, burners, and gas or electric connections in the furnace proper.

Furnace is circular, so that heat and atmosphere losses are reduced when doors are opened to charge and remove the work load. This design also reduces floor space considerably. Furnace has an automatic reciprocating motion, turning slowly in the direction of work travel, then quickly reversing. With each action work remains in forward position and regularly progresses through the chamber until it reaches a discharge chute. Unit moves on sealed ball bearings, and each movement ends gently against an air cushion. This motion is also utilized to feed workload into the furnace, and various types of hoppers to fit different types of parts are available.

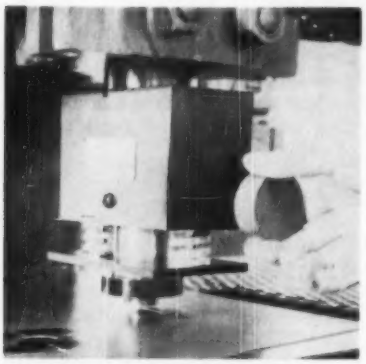
Hardening temperatures are reached in 17 min from cold. All the heat is held into work chamber by a heat-resistant alloy liner deeply embedded in insulation. By using a double turn on the retort it is possible to have 30 ft of furnace length in a 5-ft-dia space.

Lindberg Engineering Co, 2450 W Hubbard St, Chicago 12, Ill



GIANT SHEAR, Series 15012, has a capacity of 1½ in. by 12 ft of mild steel plate. Features of this machine include all-steel interlocked construction, 36-in. throat, high-pressure hydraulic hold-down system, front-controlled and power-operated back gage with 48-in. range, air-electric clutch control, and ball transfers in the table. Micrometer accuracy is maintained at an operating speed of 15 spm—*Cincinnati Shaper Co, Hopple, Garrard & Elam Sts, Cincinnati 25, Ohio*

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS



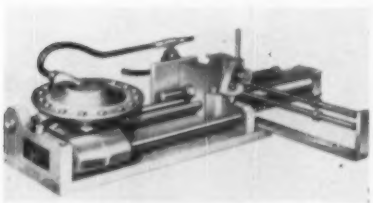
Buck Hole-Locating Attachment Simplifies Set-Up Problems

Used in standard punchpresses, attachment called the Lo-Ka-Tor locates and punches holes without the use of stops, fingers, gages, pins, or locating tables. One-hand control quickly raises or lowers punch to workpiece, independent of press ram, so that punch and hole location can be exactly aligned in the workpiece before press is tripped. When press is tripped, device automatically punches the hole, locks the punch for the upward stroke, and strips the workpiece.

When a templet is made in the above manner, repeat pieces can be quickly made by clamping the templet on top of each workpiece in turn, then lowering the punch manually into each templet hole before tripping the press.

Model 183A Lo-Ka-Tor has a capacity of 0 to 1½-in. hole in ⅛-in. mild steel, or 0 to 2½-in. hole in 14-gage mild steel. Available with standard shanks, device fits any press with a stroke not over 3 in., and with a shut height of at least 6 in.

Buck Engineering Co, Inc, 37-41 Marcy St, Freehold, NJ



Air-Operated Sesco Unit Feeds Coiled Stock

Ses-Matic Air Feed, designed for direct mounting to bolster plate of press, is designed to feed coiled stock into punchpresses. Only other tie-in needed with press is the mounting of a valve which can be tripped by some moving part of the press ram or die.

Feed is available for maximum stock widths of 8, 12, and 18 in. All models are adjustable for both width and stroke length from their maximum to 0. Thickness of stock that feed will handle is dependent on stock width: 5/32 in. up to 8 in. wide, 0.125 in. thick up to 12 in. wide, and 0.093 in. thick up to 18 in. wide.

In operation, the coiled stock being fed is guided at both front and rear. On a signal from press, a diaphragm gripper assembly connected to end of the feed cylinder grips stock with approx 1600-lb pressure along one edge of its width. Gripper then pulls stock forward to end of feed stroke, where it is released. Stock is fed on up-stroke of press.

Special Engineering Service, Inc, 8161 Livernois Ave, Detroit 4, Mich

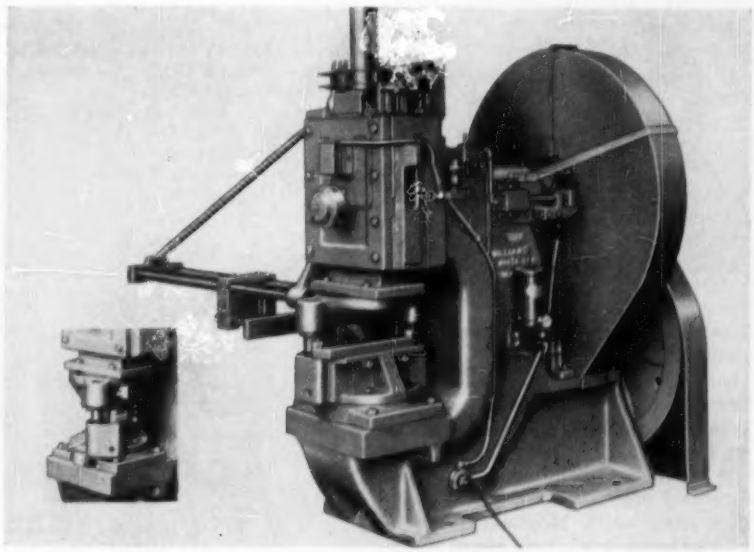
Farrand Positioning Devices Control Machine Carriages

The Inductosyn is a precision position-indicating device utilizing the inductive coupling between a pair of metallic patterns formed on glass disks. It has been developed in both linear and rotary forms: linear form has an accuracy of 0.0001 in., and the rotary form is reportedly accurate to 1 sec of arc. The rotary form, originally developed for the Air Force as an angular-measurement device of high accuracy, was offered in a form with accuracy of 5 sec of arc; the latest rotary form is a copy of the earlier version, enlarged three times to permit greater accuracy.

Significance of the devices for the metalworking industry is their adaptability to machine-tool control, more specifically, their ability to position machine-tool carriages to within the tolerances stated above.

Typical installation, company reports, was on an old milling machine converted for jig-boring operations. Inductosyn scales and a slider were mounted along the table and cross slide. These Inductosyn elements, activated electronically from a push-button keyboard, controlled a series of automatic operations comprising boring and reaming of precisely located holes. System, which can be adapted to new or existing machine tools of various types, does not depend upon the precision of the leadscrew or machine drive; measurements are always referenced to an established zero reference, so that accumulative errors are eliminated.

Farrand Controls, Inc, 4401 Bronx Blvd, New York 70, NY



SINGLE-END PUNCH, No. 14 with capacity of 100 tons, can be equipped with miter shear attachment which permits shearing bars or flats to any angle between 45 and 90° by adjustment of attachment rather than direction the stock is fed into machine. Machine is equipped with foot-button electric control and selector switch which permits single-stroke, non-repeat cycle, or continuous operation—*Williams-White & Co, 600 3rd Ave, Moline, Ill*

Syntron Vibratory Machines For Lapping and Polishing

Available in four models with pans ranging from 5 to 30 in. in diameter, lapping and polishing machines are provided with electromagnetic vibration which moves parts to be finished around the outer periphery of the pan. Vibratory motion may be increased or decreased to hasten or slow movement of parts. Various combinations of compounds and cloths can be used to obtain the necessary finish.

Illustrated is Model LP-38 with 30-in.-dia cast-iron pan. Heavy metal containers or covers can be furnished to provide weight required to hold parts down against finishing cloth on base of pan.

Syntron Co, Homer City, Penna

Building-Block Tool Controls Automate Machine Tools

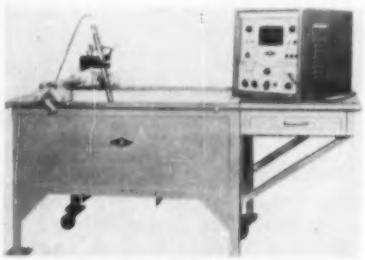
Building-block equipment in the Microtrol line has been developed to provide electronic gaging and control for individual machine tools. This "do-it-yourself" equipment, which has been designed with the small- or medium-sized shop in mind consists of a set of standard units from which the user selects those that solve his particular automatic-control problem.

Initial line of Microtrol equipment contains 57 units that comprise four categories: Electronic measuring units, offered in 5 types, provide visual indications of dimensions and can be adapted to furnish special types of measurements. Gage heads supply the electrical signals that are the basis for the dimension indications provided by the electronic measuring units. Mechanical accessories include a wide variety of items that can be used to adapt the gage heads to specific gaging applications. Electrical accessories, also available in large number, can be used in conjunction with the electrical measuring units for such purposes as making special types of measurements or automatic control of machinery.

Typical applications for the building-block equipment include the following: thickness measurement of stock being ground; inspection and sorting of parts; gaging work during production to provide automatic feedback control.

Company stresses low cost of equipment: a simple setup consisting of one gage head and one indicating unit may cost as little as $509; a completely automatic machine-control setup seldom costs more than $1500.

Airborne Instruments Laboratory, Inc, 160 Old Country Rd, Mineola, NY



Ultrasonic Testing Unit Offered by Curtiss-Wright

Model PT1001 packaged unit for ultrasonic non-destructive metal testing utilizes company's Immerscope. Package also includes a 4-ft immersion tank, search tube and rack, precision manual manipulator, longitudinal and transverse manual scanning mechanism, and a complement of crystals.

Metal parts to be inspected are placed in the tank, which is partly filled with water. Ultrasonic waves, transmitted by the search tube and crystal, penetrate the metal parts and reflect when a defect is encountered. These reflections or echos are visually presented as pips on the Immerscope screen, revealing defect to the operator. Exact position of the defect can then be determined by using the manual manipulator.

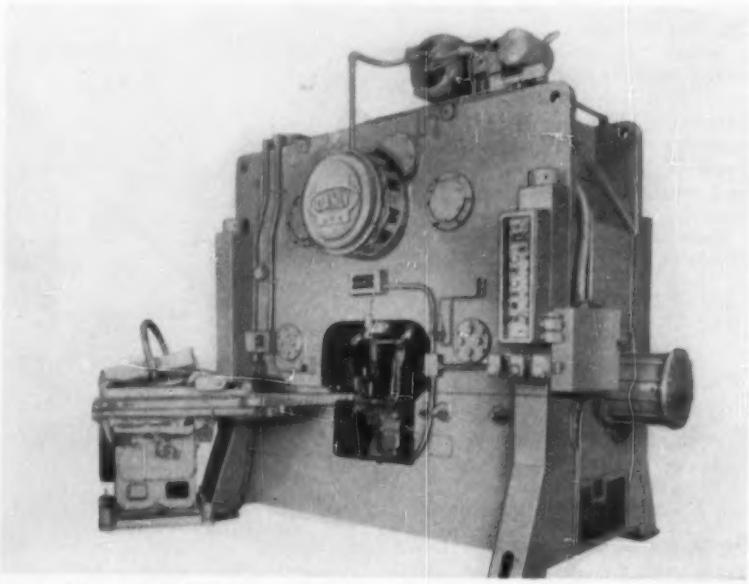
Curtiss-Wright Corp, Wood-Ridge, NJ

New Safety Solvent Tank Takes Parts Up to 20 in. Wide

Tank No. 1-W, equipped for air agitation, has automatic safety cover. Unit processes parts and assemblies up to 20 in. in width, requires only 15 to 20 gal of solvent or cleaning solution, and 2 lb of air controlled by external valve.

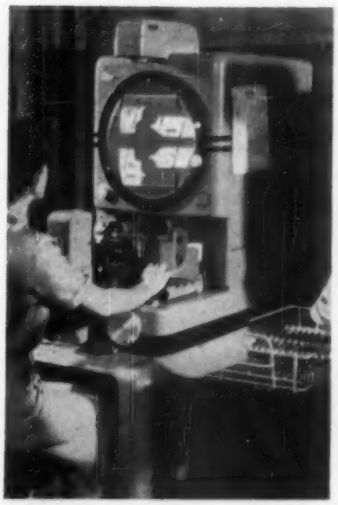
Tank is 24 in. long, 20 in. wide, 18 in. deep, constructed of 14 and 15-gage steel.

Graymills Corp, 3705 N Lincoln Ave, Chicago 13, Ill



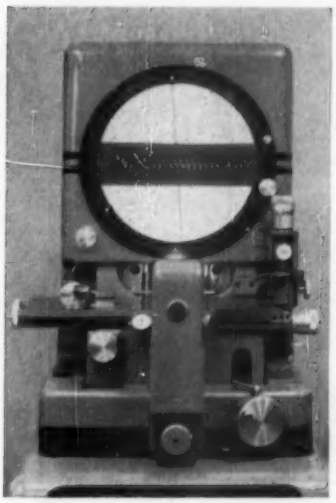
AUTOMOTIVE PISTON PINS are cold-extruded on special 100-ton mechanical extruding press, which has two slides for exerting horizontal pressures. 2500 pins per hr are produced on the press whose operation is automatic. An attached hopper supplies short lengths of bar stock to the feeding mechanism for extruding to size, including ID and length—*Danly Machine Specialties, Inc, 2100 S Laramie Ave, Chicago 50, Ill*

How many places in your plant can projection gaging save time and money?

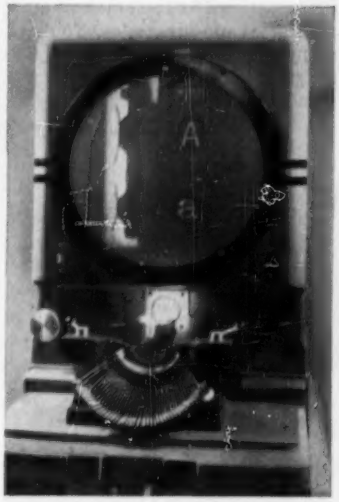


In the toolroom? Look at this. Prior to adopting projection gaging, a Midwestern manufacturing plant required 725 man-hours monthly to inspect flat drills, taps, special cutters, and circular form tools. Use of a Kodak Contour Projector reduced inspection time 84% to 115 man-hours; cost of the projector was returned in direct labor savings within three months. If you have a heavy inspection load in your toolroom, chances are that optical gaging with Kodak Contour Projectors could effect similar savings for you.

In receiving? Here's the experience of a leading maker of aircraft engines. Their gaging procedure on jet engine blades called for inspecting 11 dimensions (including radii and angles) on the dovetail contour, 14 additional dimensions on the blade root. Using two Kodak Contour Projectors, they checked these pieces at a rate of 150 per hour. And operators required little training. What about your receiving inspection department? Couldn't a fast, highly accurate method of inspecting all sorts of parts with multiple dimensions and complex shapes help prevent bottlenecks?



In production? A lot of people don't think of optical gaging in terms of production inspection. A typewriter maker did. To check the alignment of type bars to ±.0002", they placed a Kodak Contour Projector next to the soldering jigs on which bars are mounted on their arms. Catching errors at this point and correcting the jigs reduced alignment time in final assembly 25%. Install Kodak Contour Projectors next to production equipment and you have a fast, continuing check that insures machine settings are correct. That's a good way to keep scrap costs down and quality up.



In final inspection? Ever have a part that was almost impossible to inspect accurately and completely? A leading West Coast electronics manufacturer did. They had to check the precise pitch of a fine wire helix mounted in its glass tube. "Without the Kodak Contour Projector," the company reported, "it would not be practical to make the measurements necessary to get a satisfactory instrument." Many times optical gaging on a Kodak Contour Projector lets you measure small or easily distorted parts with a simplicity and accuracy you can't achieve by other methods.

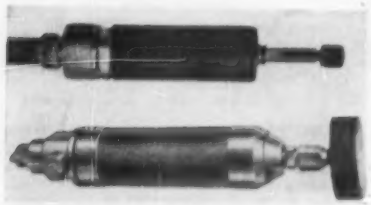
WHATEVER your inspection or measuring problem, there's a Kodak Contour Projector to do the work, from the bench-type Model 8 to the big Model 30 with its 30-inch screen and large part capacity.

To find out more about how optical gaging can save you time and money, improve accuracy, send for the booklet, "Projection Gaging with Kodak Contour Projectors." Write *Special Products Sales Division.*

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE-MARK



Pneumatic Hand Grinders Offered in Two Types

Swiss-made pneumatic hand grinders are compact, lightweight tools which attach to shop air lines with standard ¼-in. connections. Two types are offered:

Grinding pencil is 7 in. long, has 1⅝-in. grip, and weighs only 1 lb. A turbine air motor drives spindle at 100,000 rpm. Device requires only two safety precautions: automatic lubrication through the air line and resin-bonded grinding wheels limited to ⅜-in. diameter. Tool, which works at pressures between 45 and 90 psi, consumes only 7 cfm of air.

Hand grinder is 8½ in. long, has 1½-in. grip, and weighs 1½ lb. Spindle speed is 15,000 rpm, actuated by a rotary-vane air motor. Tool works at pressures between 75 and 90 psi, consumes 14 cfm of air. Standard grinding wheels up to 1½-in. diameter may be used. Automatic lubrication in the air line is not required.

Tools are priced at $60 for the grinding pencil and $45 for the hand grinder.

Imported by Hudson Equipment Co, 515 Madison Ave, New York 22, NY

Aluminum-Bronze Alloy Has High Mechanical Properties

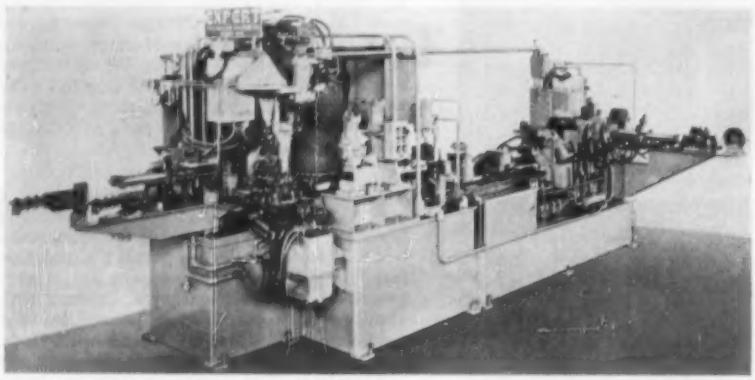
Superston 40 is designation for high-strength aluminum-bronze alloy which was initially developed in England. Material is unique in that, unlike any present bronze alloy, it contains about 12% manganese. Essentially a two-phase (alpha-beta) alloy, it is nominally composed of 75% copper, 8% aluminum, 2% nickel and 3% iron, in addition to the manganese.

Alloy is reported to surpass commercial bronze alloys in mechanical properties; it possesses higher yield strength, greater toughness (Izod notched impact strength is 18 to 30 ft-lb) and longer fatigue life than any known alloy of its kind. Whitish-gold in color, alloy melts at 1814 F and can be cast, forged, rolled, or extruded.

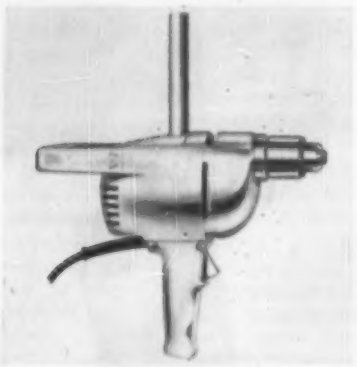
Superior casting charcteristics are reported for the alloy. Average tensile strength is said to be 105,000 psi with centrifugal casting. Yield strength at 0.5% elongation averages 50,000 psi. Brinell hardness of 190 is reported for the cast alloy. Elongation in 2 in. averages 30%.

American Brake Shoe Co, New York, and Ampco Metal, Inc, Milwaukee, have been licensed to produce the alloy in this country.

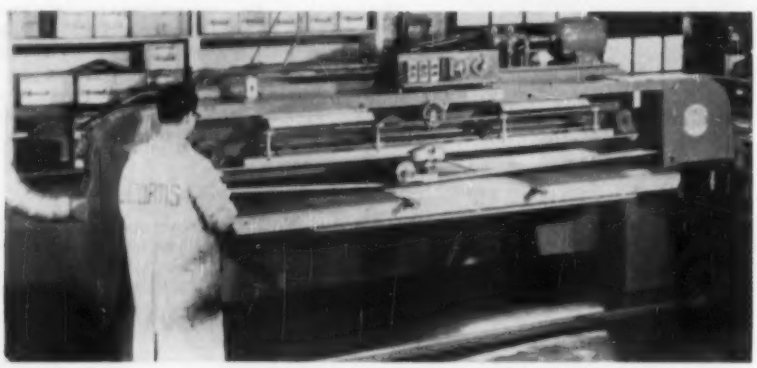
American Brake Shoe Co, 230 Park Ave, New York, NY



WIRE-BASKET ASSEMBLIES are produced from bulk wire in a continuous operation on machine that performs welding, trimming, cutting, and forming operations. Longitudinal and cross wires are drawn directly from stationary reels upward through flexing rolls and then through wire straighteners. All subsequent operations are automatic. Production rate is 170 per hr—*Expert Automation Machine Co, 17144 Mt Elliott Ave, Detroit 12, Mich*



PORTABLE ELECTRIC DRILL, Model 80, features a detachable rear handle which, when removed, makes possible use of drill in cramped spaces. Drill has ½-in. capacity in steel, redesigned power unit, and improved helical gears. 3 ball and 3 needle roller bearings offer smooth operation—*Skil Corp, Chicago, Ill*



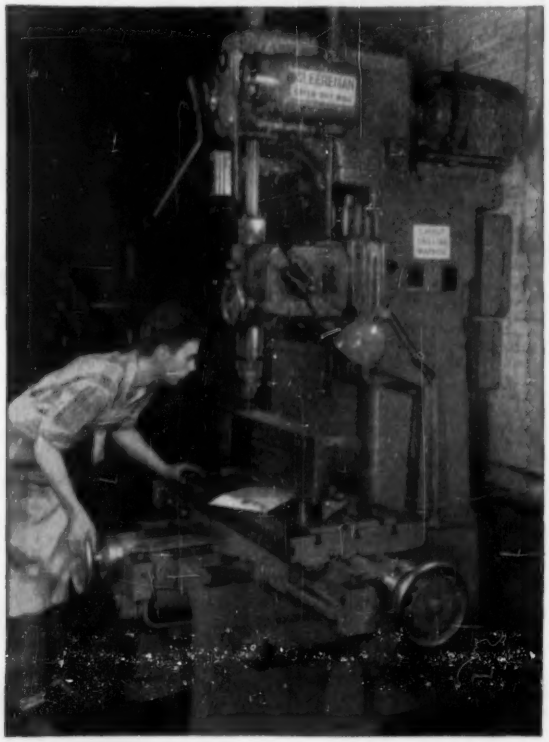
AUTOMATIC-STROKE POLISHER, Model 43-R3, will polish 2B roll-mill sheets or formed flat surfaces to No. 4 finish or better. Unit employs hydraulic system to power a traveling head at 80 to 90 8-ft strokes per min. Buff roll mounted on traveling head backs up the 6-in.-wide abrasive belt with "soft" pressure that gives a uniform finish. Stock table reciprocates under the belt with grind pressure, either by manual or air-pressure control. Machine can be built to accommodate any length or width of stock—*Curtis Machine Div, Carborundum Co, Jamestown, NY*

BUY Precision THAT FITS...!

for tenths
YOU NEED A
CLEEREMAN JIG BORER

OR

for .001"/foot
YOU NEED A
LAYOUT DRILLING MACHINE



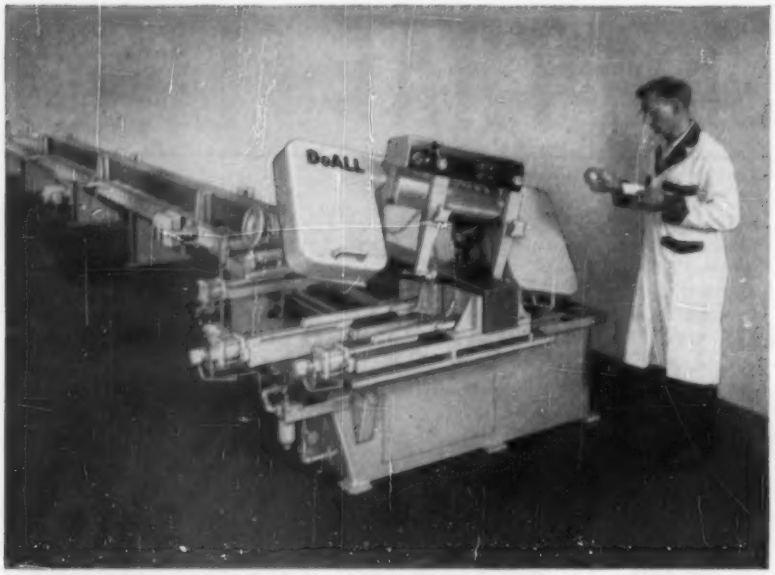
If your work involves gages, jigs, fixtures, or "jigless" production with ultra-fine tolerances, one of the three models of Cleereman Jig Borers is the answer.

But when your work calls for tolerances of .001" per foot, the economy of the Layout Drilling Machine is the "common sense" approach to your problem.

There are installations near you. Your Cleereman distributor can answer your questions and arrange an inspection visit for you.

BRYANT
Machinery & Engineering
• Company •
General Office
555 West Washington Blvd. Chicago 6
Representatives in Principal Cities

CLEEREMAN MACHINE TOOL CORP.
GREEN BAY, WISCONSIN



THIS NEW SAW cuts off pieces of a tapered steel billet by weight . . .

How Machines Fight Inflation . . .

The machine pictured above is helping counteract inflationary pressures. It is reducing the cost of cutting special alloy steel.

When the steelworkers gained their recent wage increase and side benefits they did so at the expense of others . . . and partly at their own expense. For the cost of steel and everything made of steel sooner or later must be priced higher. It is an economic fundamental that higher wages without production of more goods simply means higher prices for the goods produced.

Fortunately, American industry is constantly developing new tools to increase human productivity. This makes higher wages possible and helps retard price increases. Thus, everybody benefits.

The DoALL Power Saw shown is cutting off lengths of tapered alloy steel billets. As the thickness of the billet tapers to smaller dimension, the saw automatically cuts off longer pieces so that each is of exactly required weight. These "weighed" pieces are mixed with other metals in a melting furnace. The resultant alloy is Alnico, a permanent magnet material used in thousands of industrial and household applications.

An Alnico magnet is the "latch" on this refrigerator door . . . another modern convenience made available by newer and better tools.

The DoALL saw employs a continuous-cutting saw band of high-speed steel, a recent development which outperforms all previous sawing methods.

More and better tools like this new DoALL machine are the only real weapon against inflation caused by wage increases. Both Labor and Government should encourage industry's development and use of such tools.

Reprints available for your employees.

FREE Power Sawing Handbook describes the newest concept for reducing cut-off costs. For your copy, call your local DoALL Store or write:

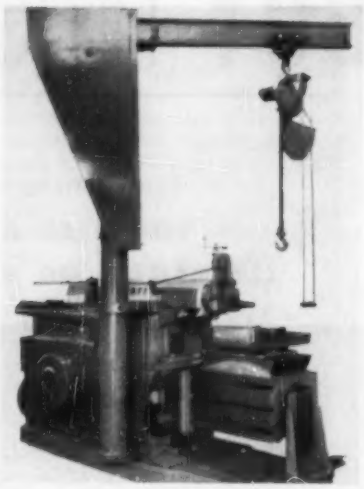
The DoALL Company

Des Plaines, Illinois

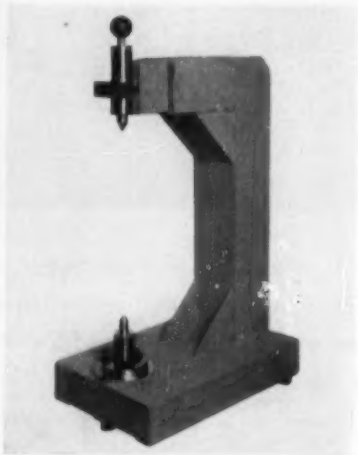
38 Local Sales-Service Stores

E-7

NEW SHOP EQUIPMENT



HEAVY-DUTY RIGID SHAPER of 32-in. size is equipped with an integrally mounted boom crane which greatly simplifies handling of heavy workpieces and fixtures. Other features of the machine include a nodular iron ram, 50-psi lubrication system, electromagnetic clutch and brake, automatic tool lifter, and universal table—*Cincinnati Shaper Co, Hopple, Garrard & Elam Sts, Cincinnati 25, Ohio*



VERTICAL CENTER designed for use on a surface plate is reported especially useful in checking runout on such parts with large flanges as rotors, pump vanes, and jet impellers. Part being checked is held vertically between centers. Upper center is retractable and spring loaded, lower center supports work. Capacity between centers is 16 in. and swing is 21 in. in diameter—*Industrial Gages, Inc, 201 N Madison St, Rockford, Ill*

For heavy duty precision drilling . . .

it's a *Jacobs* CHUCK

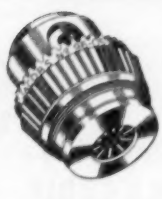
Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

THE JACOBS MANUFACTURING COMPANY • WEST HARTFORD, CONN.

The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.

The Jacobs Rubber-Flex® Tap Chuck for tapping heads and impact tools.

The Jacobs Ball Bearing Super Chuck for heavy duty and precision industrial use.



The Jacobs Model 96 Collet Chuck for grinding machines, millers and jig-borers.

The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.

The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.

Acco Registered* Sling Chains

an ACCO product

NEW!
Shaped Section Master Link
Holds its form under loads up to 18% greater.
NEW!
Accoloy X-Weld 125 Chain
Welds as strong or stronger than alloy material. Welded area 2¼ times conventional size area.

*Trade Mark Registered

New X-weld Chain— New Master Link

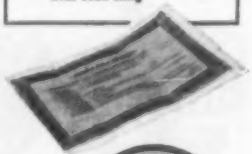
• The best has been made even better! ACCO *Registered* Sling Chains, recognized everywhere as the finest sling chains on the market, have now been made *still stronger and safer* by incorporating ACCO's great new Accoloy X-weld 125 chain and ACCO's new Shaped Section Master Link.

The Accoloy X-weld 125 chain is non-kinking. Each link has an oversize welded area with welds of full alloy strength. This means extra ruggedness and longer service life. The new Shaped Section Master Link weighs no more, but it withstands deformation under loads up to 18% greater than a conventional round section can.

Next time you buy sling chains, get ACCO *Registered* Sling Chains—they are better than ever! For full details, call your ACCO *Registered* Distributor—or write our nearest District Office.

WHAT "ACCO REGISTERED" MEANS

1. The best material
2. Unit safety factor (on bodies, rings, links, hooks)
3. Proof test of complete sling to twice the working load limit
4. Actual field service test of each design
5. Metal identification ring on each sling
6. Signed Registry Certificate with each sling



ACCO

American Chain Division

AMERICAN CHAIN & CABLE

York, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn.

plus Rings Links Hooks

NEW SHOP EQUIPMENT

Spray cleaners, designated Jet, are said to remove all types of soil from zinc, copper, brass, and steel. Low foaming action permits wider range of concentration to be used and allows cleaner to carry heavier dirt load without redeposition.

Northwest Chemical Co, 9310 Roselawn Ave, Detroit 4 Mich

Ace 18-in. Longboy drills are available in fractional sizes from 3/16 to ¾ in. These HSS drills are also furnished in 12-in. lengths.

Ace Drill Corp, Adrian, Mich

Hexclad soldering iron tips, available in 40 stock sizes and shapes, have heavy coating of iron alloy over copper base on all exposed surfaces to prolong life. Inserted part of plug tips also has coating (to protect against oxidation of the copper) thin enough so that good heat transfer to tip is maintained.

Hexacon Electric Co, 135 W Clay Ave, Roselle Park, NJ

Safety hats and caps, fiberglas-reinforced Series 4150 and 4155 meet federal specification tests for impact, penetration, electrical resistance, flammability, and water absorption. Single size flexible, polyethylene suspension cradle fits on all head shapes and sizes.

Welsh Manufacturing Co, 33 Magnolia St, Providence, RI

Worn granite surface plates are reconditioned to "as new" accuracy by process which grinds down the surface until all nicks are removed. Very large nicks that would be impractical to grind out are patched with a special cement that matches color of the granite. Company will recondition any make of granite surface plate to the following accuracies: toolroom grade, 0.0001 in.; inspection grade, 0.00005 in.; or laboratory grade, 0.000025 in.

Rahn Granite Surface Plate Co, 644 N Western Ave, Dayton 7, Ohio

Porous-metal filter elements, made of powdered bronze, are designed to filter out harmful solids and contaminants in hydraulic and pneumatic systems. Elements are made to blueprint specifications. They are available in grades of particle-size removal from 2 up to 151 microns.

Arrow Sintered Products Co, 1996 S Kostner Ave, Chicago 23, Ill

NEW

ERICKSON

MASTER SPACER

with No. 0 Timken Bearings

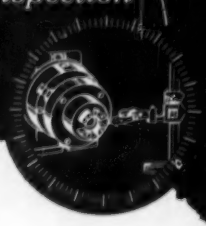
gives increased production and optimum accuracy in

straddle milling

milling

jig drilling
with either micrometer or "Jo" block setting

inspection



Write for free catalog "Erickson Master Spacer" today. And at the same time request your copy of Catalog K; you'll find cost-slashing applications for all Erickson holding tools.

The new Erickson Master Spacer quickly and accurately positions work for a wide variety of jobs. This *one* tool can eliminate expensive jigs and fixtures . . . makes it a simple procedure to set up drilling, milling, boring and special machining operations.

The new Erickson Master Spacer, ideal for tool room and production machining, assures outstanding performance under heavy helical cuts and slow feeds. *Indexing accuracy guaranteed within .001-inch cumulative error on a 6-inch diameter circle.* Jig drilling is possible with either micrometer or "Jo" block setting. Timken bearing construction permits work to be trued in position with brake off because spindle alignment remains unchanged.

The new Erickson Master Spacer can help you come to grips with your Number One Problem—high production costs. The first step is to get the Erickson story.

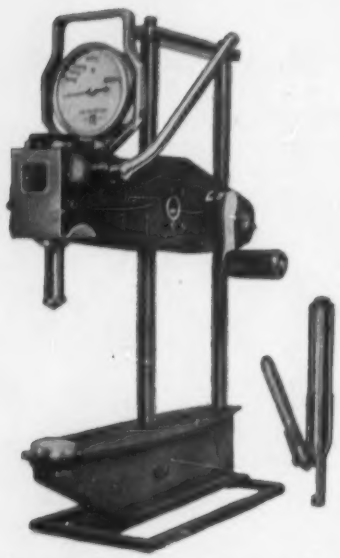
AA-3091

ERICKSON TOOL COMPANY

2309-12 Hamilton Avenue • Cleveland 14, Ohio

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • EXPANDING-COLLETS • SPECIAL HOLDING FIXTURES

Make Accurate Brinell Tests Anywhere!



KING PORTABLE BRINELL HARDNESS TESTERS are used the world over where ease of operation, dependability, guaranteed accuracy are essential.

- make tests in any position, anywhere — even in small, cramped spaces other testers cannot reach
- test parts of any size with removable test head—a King exclusive
- get accurate results every time—full 3000 kg load on 10 mm ball gives clear, sharp impression

Write for complete specifications, prices on full range of models and adapters.

KING
TESTER
CORPORATION
13th & BUTTONWOOD STS.
PHILADELPHIA 23, PA.

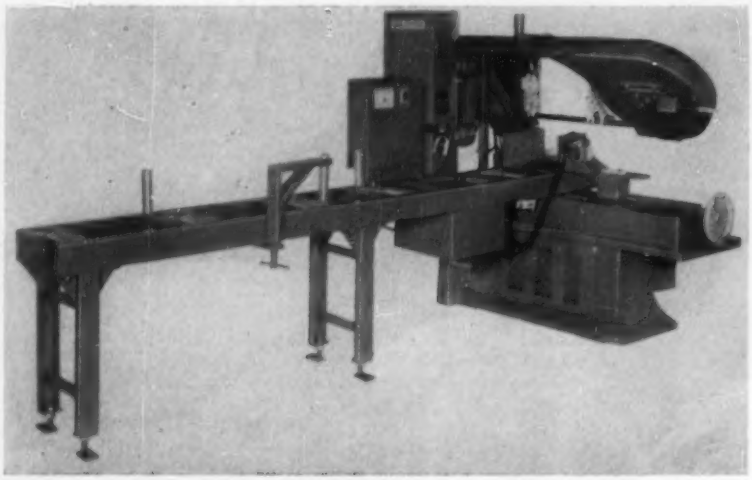
NEW SHOP EQUIPMENT

Metalworking oils and compounds recently introduced include Waynol, a completely saponifiable oil for use as an additive to cutting oils, said to have excellent wetting qualities and high film strength; No. 68 Wayne Solvent for removing purple layout dye (has flash point well above 200 F); and 3E Lubricant, a non-poisonous replacement for white lead used as a lubricant.

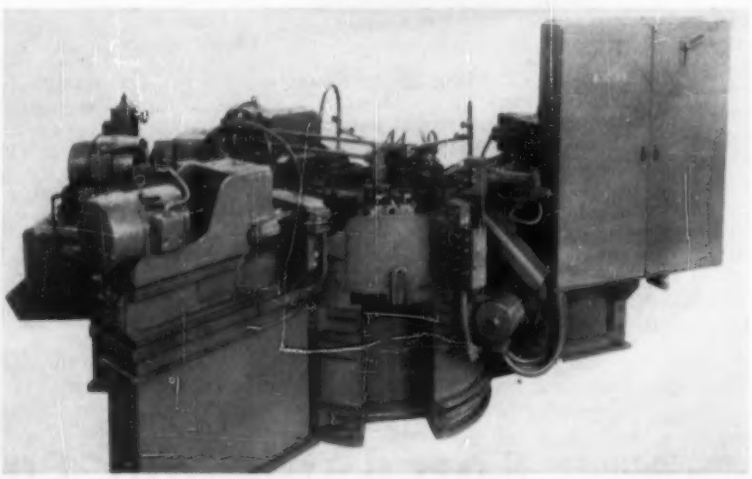
Wayne Chemical Products Co, Copeland St at MCRR, Detroit 17, Mich

Liquid oxygen cylinder LC-3 has 3000-cu-ft capacity, weighs only 505 lb. Portable unit delivers 300 cu ft per hr at 75 psi, meets all ICC safety specifications.

Linde Air Products Co, 30 E 42nd St, New York 17, NY



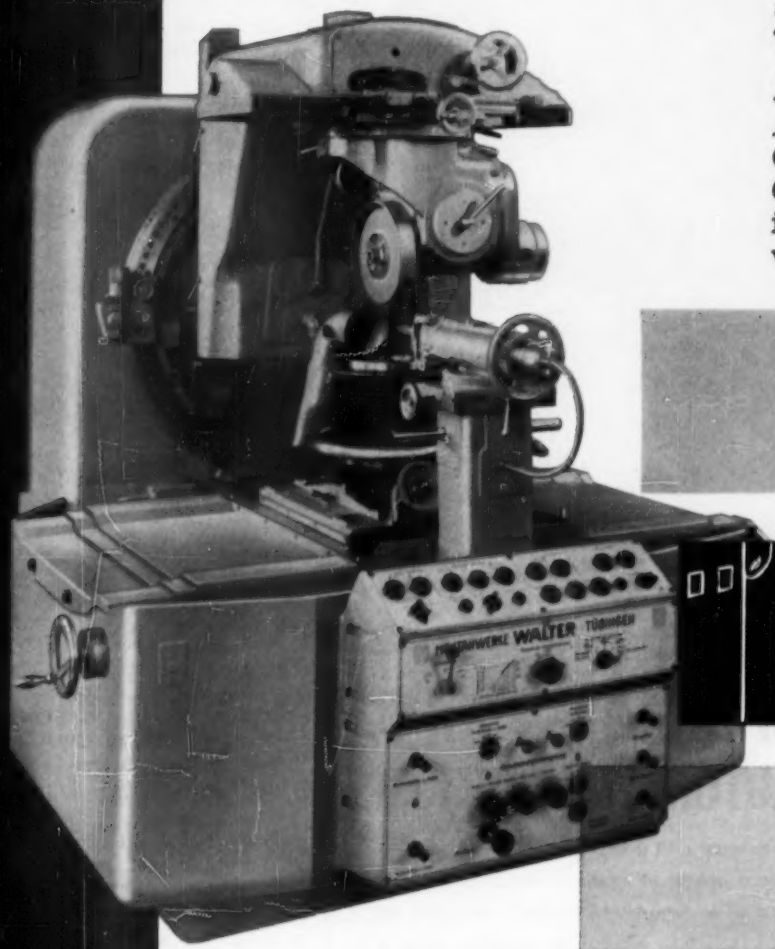
AUTOMATIC BAR FEED, called Roto-Veyor, was developed for use with company's Model 1200 horizontal bandsaw. Feed mechanism and stock-clamping action is synchronized with saw. Design features manual control (forward-reverse) switch for fast set-up or stock removal. All projection feed rollers are powered mechanically, controlled electrically. Unit has capacity of 12¾-in. OD for rounds, 12 x 12-in. rectangular shapes. It will project to within 7 in. of end of stock—*Wells Mfg Corp, 505 Roosevelt Rd, Three Rivers, Mich*



MULTIPLE-MACHINE ARRANGEMENT composed of standard, interchangeable components can be adapted to simple or complex drilling, reaming, tapping, or milling operations. Machine is designed for manufacturers with varied production to give them a one-machine answer to the usual need for several machines—*Turner Bros, Inc, Ferndale, Mich*

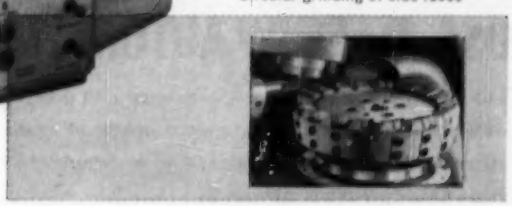
THE PROOF IS IN THE GRINDING ...

and WALTER AMS 1000 Automatic Cutter Grinder is proved versatility



Face grinding

Circular grinding of side faces



Sharpening with diamond cup wheel

...solve your most complex cutter grinding problems. New, modernized electro-hydraulic, infinitely variable speeds. Grind carbide or high-speed steel. Single setup can grind complicated side and face staggered teeth with radius corners and negative face lands. WALTER AMS 1000 sets the standard for best precision grinding of milling cutters.

Grinds right and left hand milling cutters of from 4" to 40" diameter.

Write today for complete details:

CARL hirschmann CO., INC. MANHASSET, N.Y.

LOS ANGELES • CHICAGO • DETROIT
IN CANADA: CARL HIRSCHMANN COMPANY OF CANADA, LTD.
5122 DUNDAS ST. WEST, TORONTO, ONT. • BELMONT 3-6091

largest selection of high-precision machine-tools in the United States and Canada

More Pieces COMPLETELY *finished in less time on* GOSS & DeLEEUW AUTOMATIC CHUCKERS

This machine . . . already acknowledged and accepted as a metal-working achievement, and the only standard one of its kind . . . winds up a day's operation with all parts assigned to it completely finished and with no secondary operations necessary. When fully loaded, a complete piece is finished at each index cycle. High productivity is attained with simple tooling

The "1-2-3" exclusive Goss & DeLeeuw feature provides for finishing machining three ends of a part simultaneously or in sequence. All operations are performed in a single set-up, and complete finishing done in much shorter time than by conventional methods.

Send for illustrated literature which fully describes this recent Goss & DeLeeuw development in chuckers. Submit samples of your work for time and cost estimates.

GOSS & DeLEEUW QUALITY PRODUCT-QUANTITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

NEW SHOP EQUIPMENT

Camin Process Produces Intricate Mold Cavities

Electroformed cavities are produced by a Camin process in which plastic molds are formed through the electro-deposition of nickel. Intricate molds, which cannot be produced by machining or hobbing, can reportedly be made by the process.

Several advantages are claimed for the method: Nickel does not rust or oxidize, so that damage to cavities during downtime of molds is eliminated. Nickel is not attacked by molding lubricants. No polishing of any kind need be done to cavity interiors; there is no porosity or other surface defects.

Camin Laboratories, Inc, 104-14 S 4th St, Brooklyn 11, NY

Double-acting cylinders with elliptical non-rotating piston rods are available in 1¾- and 2½-in. bores. Design is intended for applications which require accurate register of the piston rod without cumbersome external guides. Cylinders, designated Model E, are rated 250 psi air and 500 psi water or oil. They are offered with all standard interchangeable mounts, in all standard strokes, cushioned or non-cushioned.

Alkon Products Inc, 200 Central Ave, Hawthorne, NJ

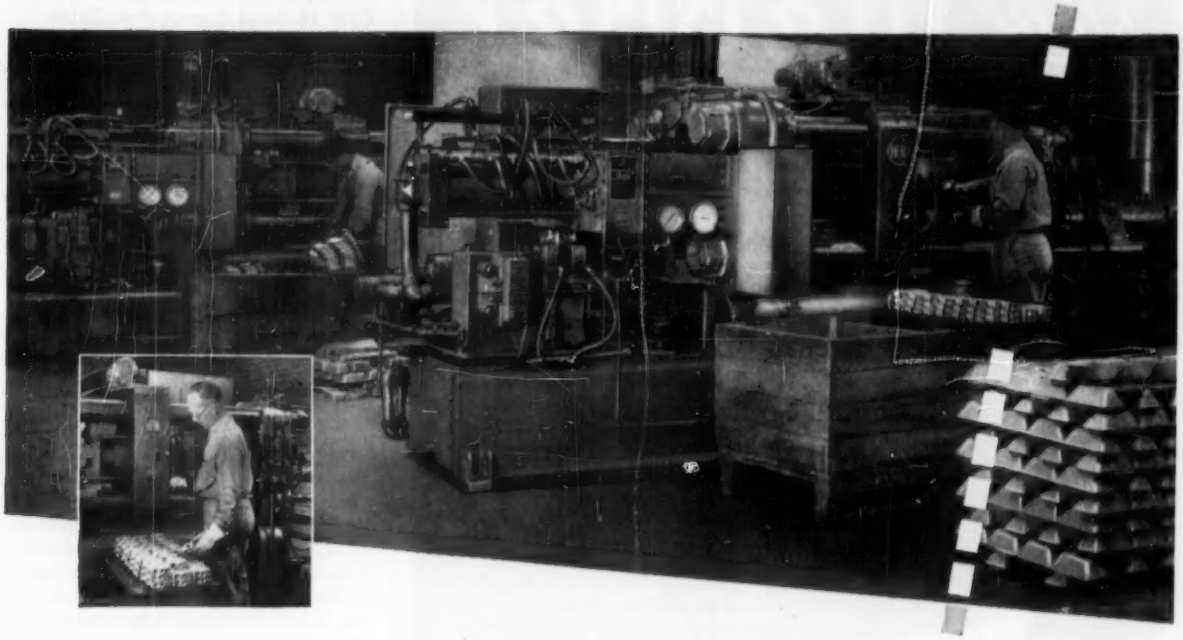
Phenolic liquid adhesive, designated EC-1471, has good peel strength and heat resistance up to 180 F. Adhesive can be used for bonding metal-to-metal panels and for bonding metal facings to honeycomb core material. Company reports that a bond with room-temperature shear strengths of 5300 psi can be obtained by curing adhesive for 45 min at 350 F under pressures of 50 to 200 psi.

Minnesota Mining & Mfg Co, Adhesives & Coatings Div, 411 Piquette Ave, Detroit 2, Mich

Self-locking thread insert of stainless steel is used for providing strong threads in light, soft material such as aluminum, magnesium, plastics, and wood. Insert's locking action is derived from one or more grip coils near the center of the insert that approximate a polygon in shape instead of being circular. As bolt is run through the insert, the grip coils are forced to conform to the thread circle, maintaining a spring-like pressure on the bolt and providing the locking effect.

Heli-Coil Corp, Danbury, Conn

PRESSURE-TIGHT CASTINGS

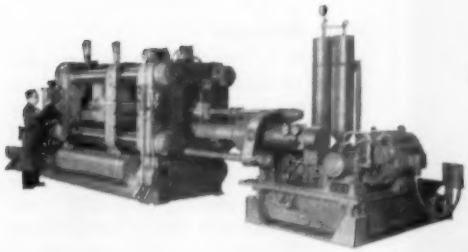


H-P-M Die Casting Machine "Locks Up Tight" For Valve Bodies of Consistent Density

When this H-P-M Die Casting Machine closes the two-cavity mold and metal is shot into intricate dies, each having cores on full three sides, the superior features of H-P-M's mechanical link wedge closing mechanism are convincingly tested. Mr. W. L. Chapman, President of The W. L. Chapman Co., Pasadena, Calif., one of the West Coast's most rapidly expanding die casting operations, says:

"These valve bodies have intricate coring detail on all sides and it takes a machine that locks up tight to produce leakproof, pressure-tight castings. One by one we are replacing all machines in our shop with H-P-Ms. We have two in operation and another on order."

Have you investigated thoroughly the production advantages of the new H-P-M Die Casting Machines? You won't have to pass up the tough jobs. Put them on an H-P-M . . . profitably!



If you have a tendency to back away from the tough ones, take a look at the new H-P-Ms. They're built to produce to the most exacting demands of you or your customer.

THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.
A DIVISION OF KOEHRING COMPANY

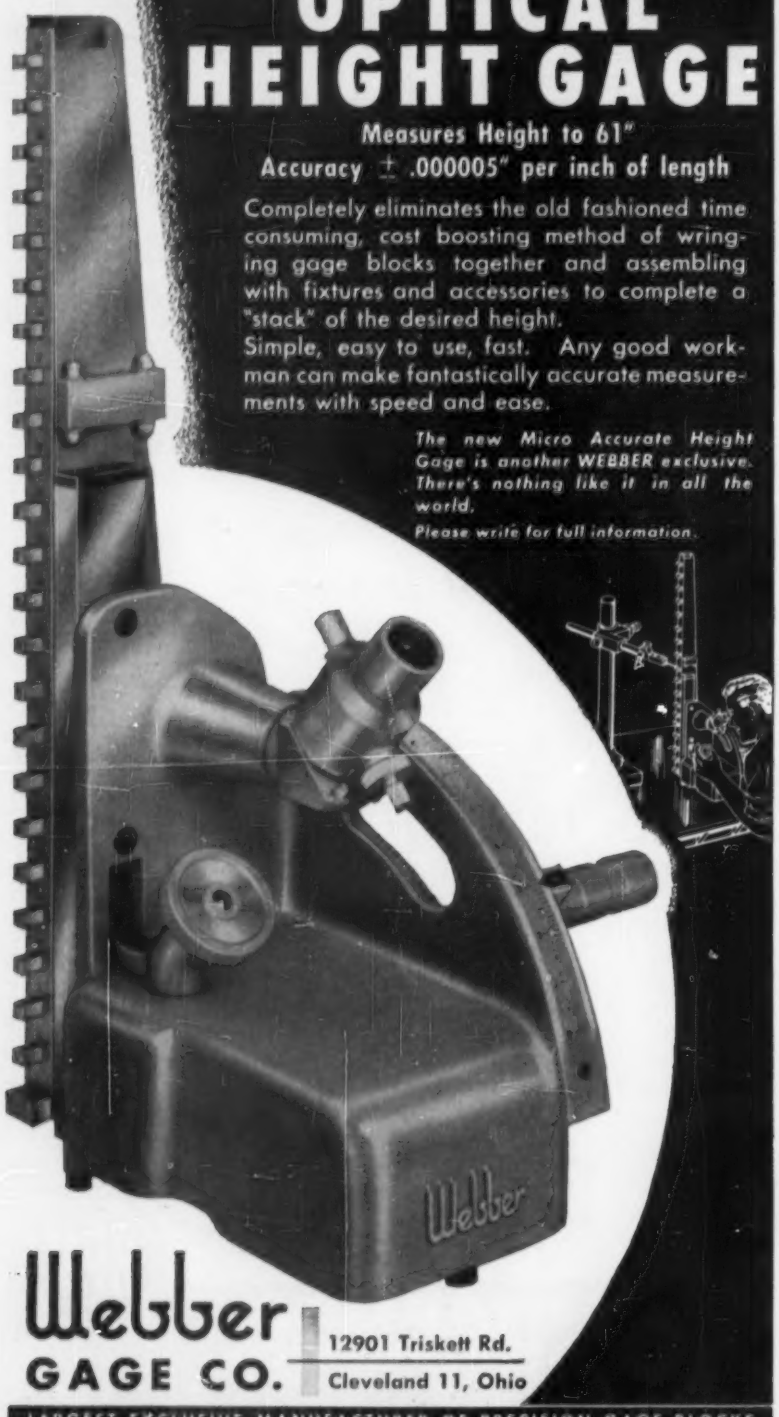
HPM

The New Webber
MICRO-ACCURATE
OPTICAL
HEIGHT GAGE

Measures Height to 61"
Accuracy ± .000005" per inch of length

Completely eliminates the old fashioned time consuming, cost boosting method of wringing gage blocks together and assembling with fixtures and accessories to complete a "stack" of the desired height.
Simple, easy to use, fast. Any good workman can make fantastically accurate measurements with speed and ease.

The new Micro Accurate Height Gage is another WEBBER exclusive. There's nothing like it in all the world.
Please write for full information.



Webber GAGE CO.
12901 Triskett Rd.
Cleveland 11, Ohio

LARGEST EXCLUSIVE MANUFACTURER OF PRECISION GAGE BLOCKS

NEW SHOP EQUIPMENT

Portable Metal-Cutting Nibbler Cuts 16-Gage Corrugated Sheet

Tool has a special nose piece and die holder which is set at right angles to the body permitting ease in handling as it rolls over the curves of the corrugated metal. Because of its design, diagonal cuts across the curves can be made, and circles as small as 2 in. in dia can reportedly be cut without distorting, flattening, or curling of the metal.

Unit weighs 7½ lb, measures 10 in. over-all, has a ½-hp high speed motor, operates from 110-v ac/dc current, cuts 33 in. of 16-gage metal per minute.

Fenway Machine Co, Edgemont & Clementine St, Philadelphia 34, Penna

Coolant aerator, Mel-O-Flo Series 1000, connects to coolant line and mixes atmospheric air with coolant, producing a non-splash aerated mixture that clings to work and tools. Self-cleaning mechanism purges the aerator of chips and sludge whenever coolant supply is interrupted. Devices are designed for 1¼ or 1-in. pipe at inlet; outlet of aerator is 1¼-in. size. Flexible hose and fan nozzle are available for outlet end.

Melard Mfg Corp, 432 Austin Pl, New York 55, NY

Centrifugally-cast stock bars, Ampco Metal Grade 18, are now available semi-finish machined. Finish allowance of 1/16 in. is provided on both ID and OD. 14 new sizes have been added to line, ranging from 1¼ to 8 in. ID and from 1¾ to 10 in. OD in standard 12½-in. lengths. Every bar is labeled on one end for convenience in stocking. Labels show ID and OD sizes to which bars will finish.

Ampco Metal, Inc, 1745 S 38th St, Milwaukee 46, Wis

Scale Remover

Alka-Deox 109 for electrolytic removal of scale and oxides from iron and steel is said to eliminate chemical attack on the metal because of alkaline nature of the chemical.

Product is said to be particularly adaptable to plating lines and automatic equipment involving alkaline or alkali-cyanide plating solutions. It can be adapted to present equipment without difficulty and, when planned for new equipment, can substantially reduce costs, according to the manufacturer.

Enthone Inc, 442 Elm St, New Haven, Conn

ROUND TABLE Discussion

QUICK STUDY . . . OR TRY-AND-SUCCEED?

Is the foreman the best judge in sizing up and placing a job applicant in his own department? Or is Personnel better equipped to gage the abilities and experience of the worker?

A GOOD FOREMAN'S quick study of a man is not the best method of evaluating his suitability for a job. There just are not enough foremen with crystal balls good enough to perform this act. Judging an industrial employee's value is too big a job for any one man. However, no man is too big to help others perform this important function.

Competitive industry's demand for manpower is as varied as it is great. Every job is important. Every man is important. Costs, quality, and production on schedule are of paramount importance.

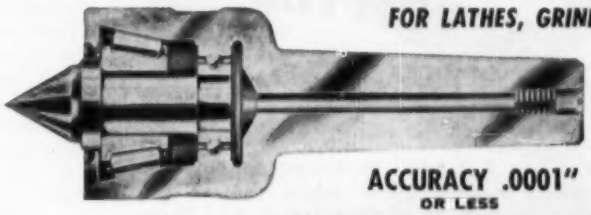
All of industry's important elements must be kept in equilibrium. There is no such thing as a high team average in industrial efficiency. Each unit must produce at just about the same average for a smooth, continuous flow of operations. Each enterprise must have its own reservoir of trained manpower to guarantee commitments to customers. A square hole is often a reservoir for a round peg.

Society is constantly making greater and greater demands upon industry. Industry's obligations to the public, the stockholder, the employee, the customer, and the supplier are becoming more and more complex. In turn, industry's demands

NOW BETTER GROUND FINISHES!

with J & S guaranteed* self-adjusting live centers

FOR LATHES, GRINDERS



ACCURACY .0001" OR LESS

with PERFECTION FREE CENTERS

SPINDLE TYPE

***GUARANTEED FOR 2000 HOURS OR ONE YEAR**

tapered Timken bearings and design accept heavier loads with guaranteed accuracy.

SIMPLE DESIGN:

Only six parts, the main body is one piece which serves as the cup for the roller bearing on which spindle turns. This permits a much greater capacity bearing in the same size body.

AUTOMATICALLY ADJUSTS FOR WEAR:

Notice the clearance behind ball bearing which allows the whole bearing assembly to move back, automatically compensating for wear on roller bearing. This maintains center's point to original concentricity.

ABSOLUTE CONCENTRICITY AND ALIGNMENT FOR BEARINGS:

Both conical and cylindrical bores of body are ground at same setting in work head. Point is ground under load in its own bearings to insure running dead true.

Design plus self-adjusting features provide accurate and chatterless grinding.

TAPERS AVAILABLE				
MORSE	JARNO	B & S	NORTON	LANDIS
2 to 7	6 to 20	7 to 18	10 to 24	.8125 1.3350 1.7500
SPECIAL POINTS, HEADS, SHANKS AND TAPERS MADE TO ORDER				

FOR INFORMATION

See your industrial distributor or write for free literature.

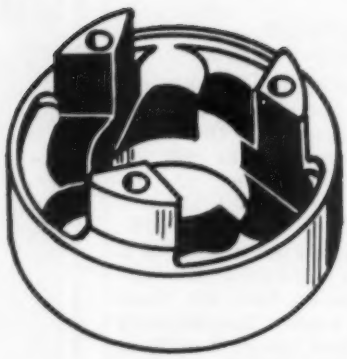
J & S TOOL CO., INC.

CLAMPCUT

870 DORSA AVE.
LIVINGSTON, NEW JERSEY

CUSTOMER SPECIFIED

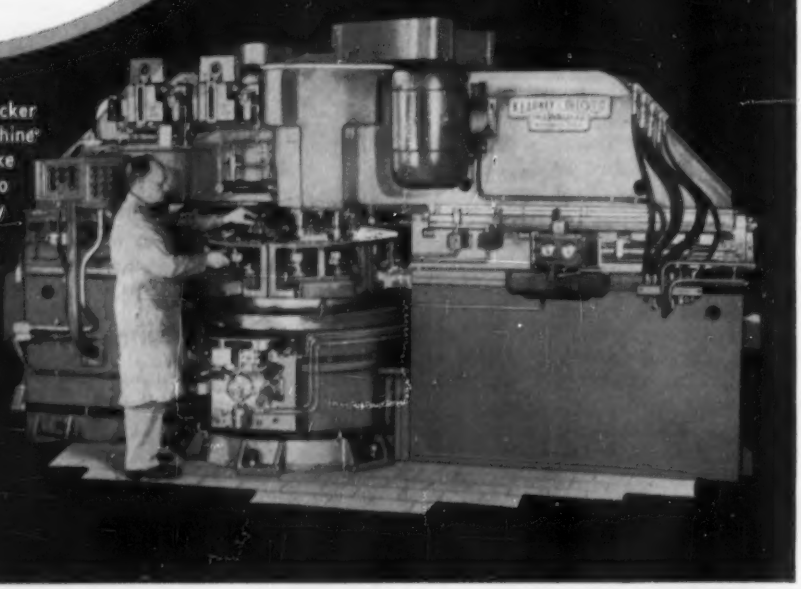
An automotive manufacturer recently asked Kearney & Trecker to design and build a special machine which would increase production milling of three pads and three pockets on transmission rear brake drums.



Black indicates machined pads and pockets on transmission brake drum.

KEARNEY & TRECKER DESIGNED

Here is our design. It's a Kearney & Trecker six-station rotary indexing milling machine which mills 162 transmission rear brake drums per hour. It does the work of two machines, each of which could mill only one workpiece at one time. With the new unit, six pieces are milled at once. A prominent feature of this machine was the application of standard Kearney & Trecker units . . . a 48" rotary index table and a 24" feed slide. This type of design appreciably decreases the overall cost of the machine. All six spindles are contained in one head which is bridged over the table. Retractable quills raise and lower the spindles.



New production efficiency starts with Kearney & Trecker Milwaukee machine tools

This typical example proves you can reduce costs and start on the road to higher production with machines designed and built by Kearney & Trecker's Special Machinery Division. With more than 50 years' experience in machine design and manufacture, Kearney & Trecker has all the ingenuity and skill required to solve special machining and production problems.

Why don't you take advantage of our abilities? They can pay off in profits for you. Your Kearney & Trecker Special Machinery Division representative will be pleased to give you all details. Call him today!

For more details on the machine illustrated ask for Data Sheet No. 1044. The free booklet "Doorway to a proven method for solution of big and small metalworking problems" is also yours for the asking.

KEARNEY & TRECKER MILWAUKEE

Special Machinery Division

MILWAUKEE 14, WISCONSIN, U.S.A.

Builders of Precision and Production Machine Tools Since 1898

ATLANTA, GA.
Scott Machine Tool Co.
411 Williams St., N.W.

BIRMINGHAM, ALA.
George M. Meriwether
Industrial Equipment
1712 Seventh Ave. North

BOSTON, MASS.
Stedfast & Roulston, Inc.
11 Dewsfield St.

BUFFALO 23, N.Y.
Syracuse Supply Co.
1965 Sheridan Drive

CHARLESTON, W. VA.
Wm. S. Belden Co., Inc.
MacCorkle Ave.

CHATTANOOGA, TENN.
Scott Machine Tool Co.

CHICAGO, ILL.
Jackson-Fotsch Co.
7350 West Lawrence Ave.

CINCINNATI, O.
The E. A. Kinsey Co.
327-335 W. Fourth St.

NEW YORK, N. Y.
Kearney & Trecker Corp.
409 Grand Ave.
Englewood, New Jersey

NEW ORLEANS, LA.
Stauss & Haas, Inc.
524 Camp St.

OMAHA, NEB.
Fuchs Mach. & Supply Co.
2401 N. Eleventh St.

PHILADELPHIA, PENN.
Machinery Assoc., Inc.
325 E. Lancaster Ave.
Wynnewood, Penna.

PITTSBURGH, PENN.
Kearney & Trecker Corp.
4 West Manilla Ave.

PORTLAND, ORE.
Harry M. Buler Co.
2811 N.E. Gilsan St.

RICHMOND, VA.
Smith-Courtney Co.
Seventh & Bainbridge Sts.

For details, contact these
KEARNEY & TRECKER DISTRIBUTORS
or write to
KEARNEY & TRECKER CORP.
6784 W. National Ave., Milwaukee 14, Wis.

CLEVELAND, O.
Kearney & Trecker Corp.
Euclid Ave. & E. 17th St.

COLUMBUS, O.
The E. A. Kinsey Co.
1020 W. Fifth St.

DALLAS, TEX.
Greene Machinery Co.
6300 Wyche Blvd.

DAYTON, O.
The E.A. Kinsey Co.
16 Washington St.

DENVER, COLO.
F. J. Leonard Co.
1219 California St.

DETROIT, MICH.
Kearney & Trecker Corp.
10600 Puritan Ave.

GREENSBORO, N. C.
Smith-Courtney Co.
239 S. Davie St.

HICKORY, N. C.
Smith-Courtney Co.
103 3rd Street, S.W.

HOUSTON, TEX.
Steel & Machine Tool Sales
6414 Navigation Blvd.

INDIANAPOLIS, IND.
The E. A. Kinsey Co.
1550 Stadium Drive

KANSAS CITY, MO.
Blackman & Nuetzel
Machinery Co.
1103 E. Armour Blvd.

LOS ANGELES, CALIF.
Moore Machinery Co.
3200 S. Garfield Ave.

MILWAUKEE, WIS.
Kearney & Trecker Corp.
6784 W. National Ave.

ROCHESTER 4, N. Y.
Syracuse Supply Co.
311 Alexander Street

ST. LOUIS, MO.
Blackman & Nuetzel
Machinery Co.
3713 Washington Ave.

ST. PAUL, MINN.
Sales Serv. Mach. Tool Co.
2363 University Ave.

SALT LAKE CITY, UTAH
Todd Machinery Co.
4165 Holloway Drive

SAN FRANCISCO, CAL.
Moore Machinery Co.
7th & Carleton-Berkeley

SAN JOSE, CALIF.
Moore Machinery Co.
656 Stockton Ave.

SEATTLE, WASH.
Dawson Mach. Co.
5700 First Ave., S.

SHREVEPORT, LA.
Peerless Supply Co., Inc.
701 Spring St.

SYRACUSE 1, N. Y.
Syracuse Supply Co.
314-332 W. Fayette St.

TULSA, OKLA.
White Star Mach. Co.
104 Boulder Bldg.
19 West 10th Street

WICHITA, KAN.
White Star Mach. Co.
301 N. St. Francis

CANADA
MONTREAL
OTTAWA
QUEBEC
TORONTO
WINDSOR
Williams & Wilson Ltd.

upon its management and workers are becoming more and more complex.

Industry's need for employees with the proper personality and skills is greater than ever before. This need exists in an ever decreasing industrial manpower pool. More vision and imagination is needed in the selection of employees than a foreman has the time and the opportunity to develop.

Personality involves temperament, extroversion-introversion, character, conformity to social standards, and ambition. Skill involves mechanical aptitude. Personality is a matter of education and domestic environment; skill is a matter of training.

Hiring a man for a job is a specialty. Considerable thought, investigation and long range planning is required. The foreman's task is to develop the utmost of capacity residing in the worker. It is the personnel department's task to evaluate these capacities.

Peter A Seward
Swampscott, Mass

IN THE SMALLER shop where the foreman is in close contact with his men I think he can do a better job of fitting the new man into the organization than any outside agency. In the larger shop, however, where a foreman has to supervise upwards of fifty men he can use the help of a good vocational guidance system in placing the newcomers to advantage.

Assuming then that Ed has this larger setup to contend with, he is missing a good bet if he does not make an effort to cooperate with

"You're not fooling anyone but yourself with that old trick, Henderson."

machines last longer...

Priced from 190.00

wear reduced 80% as much as with easy-to-move
TORIT DUST COLLECTORS

Dust causes wear, damages bearings, bedways, slides and saddles and other "sensitive" machine parts. Clean machines hold close tolerances better and need re-grinding or alignment only ⅛ as often. In five years, users of Torit dust collectors save up to $1,600 in re-grinding the ways of the average grinder—and save hundreds of dollars *more* in down-time.

MANY COMPACT MODELS . . . all self-contained. Unitized for custom installation. More economical, usually more efficient than central (built-into-the-building) systems. For more information, write today to . . .

TORIT
MANUFACTURING COMPANY
Sweet's
Dept. 407
311 Walnut Street,
St. Paul 2, Minn.

Perkins Precision Gears

Custom-Made for SIKORSKY

...made by PERKINS to SIKORSKY'S specifications for exacting, heavy duty service

Before YOU order GEARS, Check Perkins!

PERKINS MAKES:

to customers' specifications, in all materials, metallic and non-metallic: bevel gears, ratchets, sprockets, ground thread worms, spiral gears, helical gears, spur gears with shaved or ground teeth.

NOTE: The PERKINS PRECISION SPRING COILER is the latest development in the spring coiler field and eliminates entirely the use of arbors and long set-up time. It is a complete self-sufficient machine and enables you to make the spring you want when you want it—in seconds. The coiler produces any type of spring, in any diameter and any pitch with this range: Wire sizes .005 to .125. Diameter, from 3/32" to 12" and larger. Size of the compact coiler is only 7½" x 16". A POWER MODEL is available. Information on request.

PERKINS MACHINE & GEAR CO.

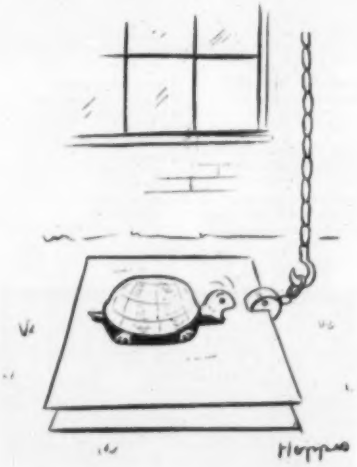
101 Circuit Avenue, WEST SPRINGFIELD, MASSACHUSETTS

Personnel in their efforts to find men who will fit into his production scheme with the minimum of breaking in. If Personnel has obtained the services of a good set of instructors, men who have gone through the various operations in the shop and know what type of individual is best suited for these operations then Ed has nothing to gripe about. For instance, if they know Ed can use a man who has the makings of a first class lathe hand they are not likely to send him a fellow who does better on a milling machine, or a fellow who doesn't like to stay put at a machine but is happiest at assembling. In other words, the vocational guidance people save Ed the time and headaches required in knocking the corners off the square peg to fit it in the round hole.

So far as evaluating personality is concerned, my money is on the good instruction every time to do a better job than the busy foreman, for the simple reason that the foreman has to divide up his time in smaller segments than the instructor when it comes to a question of personal contact. We know that in most shops the foreman is so tied up, production-wise, that his chances of taking time to study each man's personality traits are about equal to his chances of winning the Irish Sweepstakes.

Let's face it, Ed. Can you really afford that hour you talk so glibly about, to size up the new man and put him in his proper station? Or are you just one of those guys whose mind goes back to the days when the foreman was a little king, whose presence was requested in the front office whenever a prospective subject showed up looking for leave to toil.

Times have changed, Ed, and we



have to change with them. So give the boys in Personnel a break. You may be pleasantly surprised!

Robert S Alexander
Glastonbury, Conn

TAIL-END CHARLIE

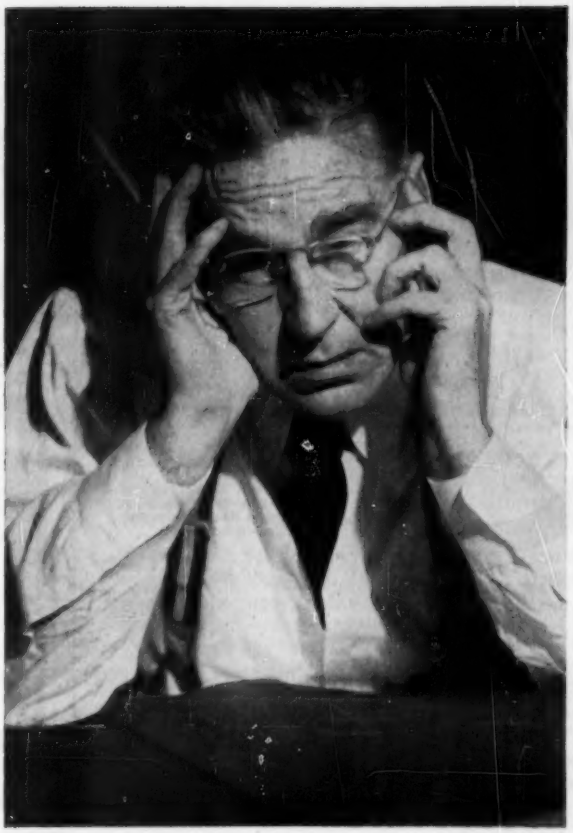
Is it fair to pass over a man for promotion because of frequent absenteeism and tardiness, particulaly if he has seniority rights to the job?

REPEATED lateness and a poor attendance record is a good indication of a hidden problem. These two faults are serious in themselves and serve as evidence of the existence of some difficulty. The man may be a secret drinker resorting to alcohol as an escape. He may have a hidden hatred for his job or his supervisor. There are numerous possible reasons for this individual's poor record; he may be frustrated, or he may be faced with family problems he cannot solve.

This individual is highly skilled and well versed in the varied requirements of his job but it takes a lot more than this to make a good group leader. He must have those uncommon qualities of enthusiasm and leadership which are so difficult to describe. These qualities are hard to find ready-made and are difficult to teach and instill.

In his appraisal and consideration of this employee for the position of group leader the foreman can take either of two positions. He may assume that the poor attendance record and frequent lateness is an indication of the existence of a serious problem in this man's background. If he makes this assumption he has good reasons for not giving him the job as group leader. As a consequence of the lack of evidence and a desire for fairness the foreman may consider only the problem of lateness itself, disregarding any assumptions about possible reasons. In this case he can only attribute the poor record to a lack of interest and a disregard for the rules and regulations of the company. If the foreman considers either or both these alternatives he cannot reach any decision except that of giving the group-leader job to the man with the good attendance record even though he has had fewer years on the job.

Henry George
Yonkers, NY



send it out to CDT

There is no faster, more reliable way to get help with difficult tooling problems than to send it to Columbus Die-Tool. Backed by 50 years of experience, CDT has three basic objectives when designing and building tools, jigs, fixtures or special machinery.

1. Increase Production
2. Improve Quality of Product
3. Lower Production Costs

These and other benefits are reasons why so many of the nation's leading manufacturers regularly avail themselves of the specialized services of Columbus Die-Tool. Perhaps we can solve your tooling problem and help you make your product . . . better, for less.

Columbus Die-Tool
AND MACHINE COMPANY

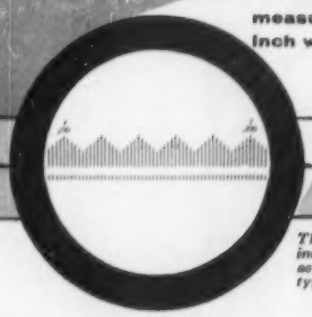
P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*

Make Precision Measurements Faster and More Accurately!

The NEW Direct Reading EMscale

measures to 1/10,000 of an inch with Vernier Eyepiece



This is the EMscale, divided into thousandths of an inch, as it appears through a simple type microscope.

Now for the first time you can measure to thousandths and ten thousandths of an inch, clearly, sharply, accurately with a direct reading scale. Introduces a new concept in micro-measuring with almost unlimited application.

Learn all the facts. Send for this EMscale brochure today.

ELLIOTT-MYERS Corporation
51 Hammond Rd. • Warren, Pa.

OPTICAL MEASURING DEVICES

A SPECIALIZED CAM MILLING SERVICE
Over 100 Types of INDEXING TURNTABLES

CAMS OF ALL TYPES

Also Geneva Gears, Spot and Butt Welding, Positioners for Brazing, Spraying, Welding and Soldering

Dr. Chas. Eisler ME, Founder
Chas. Eisler, Jr., Pres.

Mfrs' agents wanted

Contract production; Special automatic machines

EISLER ENGINEERING CO., INC. | 751 SOUTH 13TH STREET NEWARK 3, N. J. U.S.A.

DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

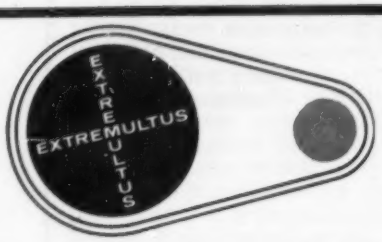
Write for sample on company letterhead

THE DYKEM COMPANY
2301B North 11th St. • St. Louis 6, Mo.

CUT SCRAPER TIME
END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2301B NORTH 11TH ST., ST. LOUIS 6, MO.



NO DRIVE TOO TOUGH!

In its first year on the U. S. market,

EXTREMULTUS BELTING,

a laminate of leather and plastic, is out-performing and replacing existing V-belts, chains and flat belts everywhere!

- Speeds up to 10,000 feet per minute!
- Ratios as high as 20:1, with arcs of contact as low as 90°!
- Unexcelled elasticity — soaks up shock!
- From 1/10 to 6000 HP!
- Runs on standard pulleys!
- Greatly reduced bearing loads!
- Freedom from stretch eliminates take-up!
- Widths a fraction of belts replaced!

Immediate delivery from stock on standard sizes

Name your drive problem — let EXTREMULTUS solve it!
Write *today!*

EXTREMULTUS, INC.
405 Lexington Ave., New York 17, N.Y.

DAVIS KEYSEATER

This low cost machine will handle internal keyseating jobs up to 1 in.

Write for illustrated bulletin.

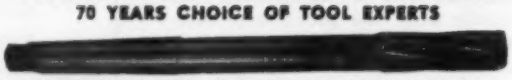
DAVIS KEYSEATER CO., 403 Exchange St., Rochester, N. Y.

TANNEWITZ

VARIABLE SPEED TOOL ROOM BAND SAWS AND HIGH SPEED METAL CUTTING BAND SAWS SINGLE OR VARIABLE . . . 50 TO 15,000 FPM. PRODUCT OF MORE THAN 50 YEARS OF SPECIALIZATION. Write or phone.

The TANNEWITZ WORKS Grand Rapids, Michigan

ATTENTION REAMERS BUYERS
70 YEARS CHOICE OF TOOL EXPERTS



REAMERS, MILLING CUTTERS, END MILLS, SPECIALS

ALVORD-POLK TOOL CO. Millersburg, Pa.

H&C Insert Chaser DIE HEADS

famous for accuracy and straightness of threads, low chaser costs, less downtime, more pieces per day.

THE EASTERN MACHINE SCREW CORP., 20-40 Barnby St., New Haven, Conn.
Pacific Coast Rep: *A. C. Berhringer, Inc., 554 N. San Pedro St., Los Angeles, Calif.* Canada: *F. F. Barber Machinery Co., Toronto, Can.*

The NEW AMERICAN MACHINIST'S HANDBOOK

Edited by
RUPERT LE GRAND
Senior Associate Editor, *American Machinist*
Based upon earlier editions of
AMERICAN MACHINIST'S HANDBOOK
edited by Fred H. Colvin and Frank A. Stanley
1579 pp. 5¾ x 8, 774 illus., $11.00

Here's the biggest news in years for machinists, toolmakers, apprentices, designers, engineers, inspectors—in fact *all* in the metal working industry. Now you can have the on-the-job help of an *amazingly improved, fully-up-to-date,* NEW AMERICAN MACHINIST'S HANDBOOK.

Long a highly-regarded working tool, this book now has been completely revised and modernized in every way to make it a practical companion for technical men. Whether it's in design and drafting—machining and forming methods—metal finishing—or other major phases of your work—your problem can be better answered, solved more quickly, easily, and dependably with the aid of the wealth of modern descriptions, practices, and data given in this book.

BIGGEST IMPROVEMENT IN NEARLY 50 YEARS!

80% rewritten
Rearranged to give more facts—easier reference.
Fully up-to-date
1579 pages
774 illustrations
45 big sections

The facts behind this monumental change

Think of the advances of recent years in metalworking in all its aspects—not only the normal development of better tools and techniques in an important industry, but also the further advances demanded by work on new materials and new design applications! *The growth in metalworking technology, standards, and practice has been tremendous* — faces every man in the field with a great need for new working information. To meet this urgent need, the NEW AMERICAN MACHINIST'S HANDBOOK has been created — fully abreast of today's practice—and given to you with the practical treatment and handy reference features that will make this the "bible" of the industry for many years.

Gives day-to-day help in your work

The NEW AMERICAN MACHINIST'S HANDBOOK is so concisely written, so logically arranged, so packed with facts, that you'll find it of almost daily use in your work. Look up in it questions, large and small, on layouts, feeds, speeds, tools, jigs, fixtures, materials, standards, tolerances, forming and finishing methods—hundreds of details of machine shop and drawing room practice. You'll find the authoritative answers that will mean time and money saved and better results in all your work. See for yourself—have the book at your elbow—consult it for 10 days at our risk. No obligation to keep it unless it meets your needs. Just mail the coupon below.

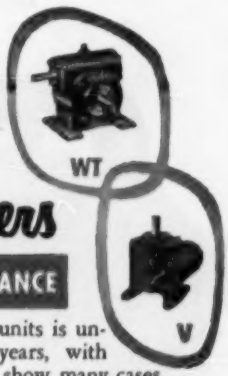
10 DAYS' FREE EXAMINATION

McGraw-Hill Book Co.
Dept. FA-12-31-56
327 W. 41 St., N.Y.C. 36

Send me Le Grand's NEW AMERICAN MACHINIST'S HANDBOOK for 10 days' examination on approval. In 10 days I will send $11.00 plus few cents for delivery costs or return book postpaid. (We pay delivery costs if you send remittance with this coupon; same examination and return privilege.)

(Print)
Name .....
Address .....
City ..... Zone ..... State .....
Company .....
Position .....
For price and terms outside U.S., write McGraw-Hill Int'l., N.Y.C. FA-12-31-56

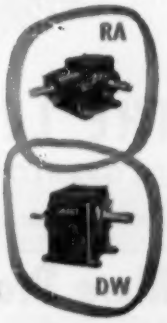
Grant Speed Reducers



YOUR ASSURANCE OF BETTER PERFORMANCE

The *real* criterion for reduction units is unfailing performance over the years, with minimum maintenance. Our files show many cases where Grant Reducers are still providing every-day service, after two decades, without a breakdown.

What's back of such performance? Extra-quality features built into each Reducer, by gear experts . . . totally enclosed cast iron housings, radial thrust ball bearings, precision high-test bronze gears and worms of chrome vanadium steel. These features mean money in your pocket through trouble-free operation.



Grant manufactures a complete range of types and sizes — worm, double worm, compound worm and spur, helical and mitre gear — with reductions up to 3660-1 — most available from stock. Write for the latest catalog, describing each type in detail.

STOCK GEARS SPECIAL GEARS
SPEED REDUCERS

GRANT GEAR WORKS INC.

Founded in 1877 by George B. Grant, the Pioneer Gear Man

140 WEST SECOND STREET BOSTON 27, MASS.

RANDALL and STICKNEY
Dial Gauges and Indicators

are accurate, reliable and built to stand hard usage.

Model "C 50 B" has a 2½" overall diameter, balanced dial 0-25-0 with .0005" graduations, ½" range and movable dial easily set at zero.

The cases on all R. & S. Gauges are made from sturdy castings. The case and plate are two separate units so that repairs can be made easily.

This style instrument can be furnished with various dials, graduations and ranges, in both English and Metric. There is an R. & S. Gauge for practically every purpose. Write for circulars describing our complete line.

FRANK E. RANDALL CO., INC.
248 Ash St.
Waltham 54, Mass., U.S.A.
Makers of Dial Gages Since 1894

Don't Let the Word 'BATCH' Fool You!

MANY DRYING JOBS CAN BE DONE MORE EASILY AND QUICKLY —WITH LESS LABOR

in a **BARRETT CYCLONE DRYER**

because it is ...

- Built for large loads
  Up to 425 pounds with 3½ bushel capacity
- Extremely fast
  Surplus moisture is snapped off in seconds—remaining film absorbed quickly by natural suction or, if necessary, hot air blast.
- Designed for difficult drying jobs
  Empties water from blind holes and cupshaped parts by reverse spinning.

THE LEON J. BARRETT COMPANY

1800 GRAFTON ROAD **WORCESTER, MASS.**

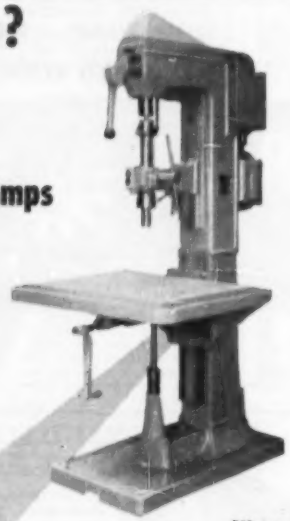
More Production?

Specify

RUTHMAN

GUSHER Coolant Pumps

Your Gusher Coolant Pump gives you instantaneous coolant flow the split second you turn on the machine. There is no priming necessary, chips cannot injure the pump. You're sure of a long trouble-free life . . . high production when you specify Gusher Coolant Pumps for your machinery. Write for our *New* Catalog.



Illustrated is a Column type Avey Drilling Machine equipped with a 11020 B-Short Ruthman Gusher Coolant Pump.

THE **RUTHMAN** MACHINERY CO.

1818 Reading Road Cincinnati, Ohio

Cancer can't strike me, I'm hiding.

Cancer?

The American Cancer Society says that too many people die of it, NEEDLESSLY! That's why I have an annual medical checkup however well I feel. I know the seven danger signals. And when I want sound information, I get it from my Unit of the

AMERICAN CANCER SOCIETY

MODERN BUSINESS

AND MODERN SCHOOLS

NEED EACH OTHER MORE THAN EVER!

This has been a great year! America is building and replacing and thus moving faster than ever before.

Only one thing. Will the labor market keep pace?

That's where schools are important. If your company isn't helping community groups to get modern schools, it's not apt to get the skilled people it needs. Self interest, civic spirit, or both, you should make schools your business, too.

PUBLIC SERVICE ADVERTISING COUNCIL

Want to find out how to help in *your* community?
Get specific information by writing:
Better Schools, 9 East 40th Street, New York, N. Y.

Gaging . . .

the Surplus Machinery Market

"The big dealers are doing all right nowadays, but the little ones are going to pot," is a statement we've heard made more than once in the last few weeks. Whether or not it's true generally, there is certainly evidence to back it up in the wide variance in business outlook among dealers, which ranges anywhere from a "business is shot to hell" attitude to rosy optimism over cash register receipts for some time to come. And it's usually the little fellows who complain things have gone to pot, and the big ones who like the way things are going.

Generally, there don't seem to be as many customers out looking for surplus machines as there were a few months back. One reason could be that most dealers today just don't have the inventory to attract "lookers." And in turn that lack of inventory can be traced to just one thing—ordinarily, along about year's end, the top brass at metalworking plants becomes housekeeping conscious, decides to sell out all the surplus stuff in the plant to dealers. This year it just hasn't happened on anywhere near as big a scale as it has in the past.

This bears out the theory that most plants are afraid of rising prices for both new and used machine tools, figure that they'll get more from their sale as time goes on, and, alternatively, that if they sell out old machines now and an emergency comes up, they'll have to spend a lot more to replace them. For this same reason, companies that have just bought new machine tools are hanging on to the old ones, too.

In spite of that, most dealers are pretty optimistic about what 1957 will bring in the way of business. Demand continues very strong, and the dealer who can get top-quality used machines will have little or no trouble selling them. There are exceptions, of course, like sheet metal fabricating machinery, whose buyers are getting pretty choosy because a lot of this type of equipment has come onto the market in the last year or so and the "critical" demand is pretty much satisfied.

Strongest demand across the country is for knee-type milling machines, engine lathes, radial drills and turret lathes—but they have to be good ones. Even in today's short supply, you have a tough time unloading junkers.

Also in high demand: A-1 large vertical boring mills with 54 to 100-in. tables, and big engine lathes with 24-in. swing and up, particularly those with large capacity between centers.

Depends on who you talk to today whether you get a sunny or gloomy picture of year's end business. Take Chicago, for instance. Here are the in-a-nutshell reactions of five Windy City dealers: "Sales dropped 'way down—can't see any reason for it"; "Business took a healthy jump upward in November, should stay that way all through 1957"; "Sales are moving upward, but demand is spotty—there just aren't as many potential customers out looking"; "Sales are fairly good now, and they're going up a little. Prices have firmed up some, at least"; and "Sales are holding up very well, even though inquiries have slowed considerably."

United
EVERY TIME!

CYLINDRICAL GRINDERS
NORTON 14" x 36" Type C Plain—1942
CINN. 6" x 18" Model ER Semi-Auto.—Filmatic
NORTON 6" x 30" Type C Hydr. Plain
B & S #2 14 x 30 Univ.
B & S #1 10 x 20 Univ.

SURFACE GRINDERS
COVEL #20 6" x 18" Hor. Hydr.
NORTON 6" x 18" Hor. Hydr.
NORTON 6" x 18" Vert. Hydr.
THOMPSON 12" x 16" x 60" Hor. Hydr.
HILL-ACME 18" x 72" Hor. Hydr.

ENGINE LATHES
AMERICAN 16" x 60" High Duty—1940
REED PRENTICE 20" x 78" 16-Speed
AMERICAN 12" x 30" High Duty

TURRET LATHES
B & Q #7 2½" Chucking
GISHOLT #4 2" Ram Bar or Chucker
GISHOLT #3 1½" Ram, Bar or Chucker
GISHOLT #5 2½" Ram, Bar or Chucker
GISHOLT 2L 3½" Saddle—Taper—Threading
W & S #2 1" Ram, El. Bar
W & S #3 1½" Ram—Chucker
W & S #4 2" Ram—Bar—Preselect
W & S #5 2½" Ram—Bar—Preselect

MILLERS
B & S 2B Hi-Speed Plain
VAN NORMAN #12 Tool Room
K & T 3H Ver., Power Feed to Head
VAN NORMAN #22LU Univ. Div. Heads

PRODUCTION MILLERS
CINN. #08 Plain
CINN. #4-36 Hydromatic, 2-way cycle
K & T 18-54 Simplex
CINN. #2-24 Plain

INJECTION MOULDERS
FELLOWS 1B-15 3-oz.—1951
REED PRENTICE 10D 8-oz. Double Toggle

SHAPERS
MOREY 12" Vertical
GOULD & EBERHARDT 14" Universal
HENDEY 16" Universal
HENDEY 20" Universal

TAPPERS
W & S #10 Lead Screw Type
BAKEWELL #1 Lead Screw Type
BAKEWELL 1R Radial

United
MACHINERY & TOOL
CORPORATION
83 THOMAS STREET
WORCESTER 8, MASS.

BUY FROM STOCK
Telephone
BAKER 5-5887

FALK
MACHINERY COMPANY

10 WARD ST.
ROCHESTER 5
N. Y.

Every Item Guaranteed as Represented

LATHES

24" x 12' BOYE & EMMES Grd. Head, Timken Bearing, Taper Attachment.

4 DE POTTER & JOHNSTON Automatic Turret Lathe, Late Type.

24", 36" BULLARD Vertical Turret Lathe, Turret Hd., Side Hd., M.D.

No. 2, 3, 4, 6 WARNER & SWASEY Univ. Turret Lathes, Bar Feed.

No. 2, 7 BARDONS & OLIVER Universal Turret Lathes, Preselector, Bar & Chucking. Late Type.

17" x 8' LeBlond Regal Grd. Hd. Lathe, M.D.

DRILLING MACHINES

28" BARNES Upright Drill Press No. 242 M.D. Box Column, Power Feed.

3', 4', 5', 6' CINCINNATI BICKFORD Radial Drills.

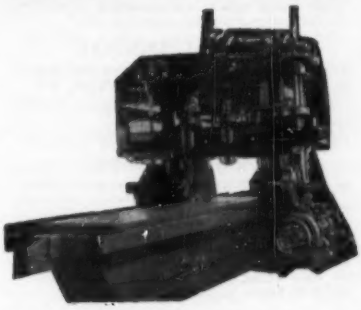
No. 2 M. T. Six Spindle ALLEN Type KH Drill Press. Individual Motor Drive. Late Type

MILLS

0-8 CINCINNATI Horizontal & Vertical Prod. Mills, M.D.

No. 2HL Kearney & Trecker Horiz. Mill, M.D., Late Type.

1A PRATT & WHITNEY Jig Borer, with Gauges, Rods, Collets and Chuck



No. 2 BROWN & SHARPE Vert. Mill, Light Type, Swivel Head, M.D. Late

42" by 36" x 12' INGERSOLL Planer Type Mill, two heads on rail, two side heads, M.D.

48" CINCINNATI Duplex Automatic Prod. Mill, M.D.

No. 2, 3, 4, 5 CINCINNATI Hi Power Horiz. Mills, M.D.

PRESSES

No. 6 BLISS Straight Side Press Double Crank 135 Tons Cap., Motor Driven.

400 Tons CHAMBERSBURG Hydraulic Wheel Press, 14" Ram, 96" between Tie Bars, 12' to End Support, M.D

3W WATERBURY FARREL Hi-Speed Blanking, 60 Tons Cap., 1½" Stroke, Reeves Drive.

GRINDERS

No. 13 BROWN & SHARPE Universal Tool & Cutter Grinder, Complete Tooling.

4' x 12' LANDIS Hydraulic Plain Cylindrical Grinder, M.D. Late Type.

6" x 18" NORTON Hydraulic Horizontal Surface Grinder, Permanent Magnetic Chuck, Coolant System, Late Type.

No. 14 W HAMMOND Double End Carbide Grinder, M.D.

6" x 10" x 48" NORTON Hyd. Horiz. Surf. Grinder, M.D.

4T SELLERS Tool Grinder, MD. Late Type.

30" INGERSOLL Fo[illegible] Mill Cutter Grinder, M.D. Late Type.

6" x 18" LANDIS Type "C" M.D. Hyd., Cylindrical Grinder, Serial #29196.

MISCELLANEOUS

18 KW SCIENTIFIC ELECTRIC Induction Heater, Tube Type.

No. 8LS FELLOWS M.D. Gear Lapping Machine, Detachable Head, Univ. Work Support.

1AA, 3A, 4A, 5½B, 7B ROCHESTER High Speed Rivetting Hammers & Staking Machines

No. 00G BROWN & SHARPE High Speed Automatic Screw Machine, M.D. Late Type.

No. 6 BROWN & SHARPE Automatic Screw Machine. M.D., 2" Capacity.

8' x 18 Ga Wysong & Miles Foot Shear, Late

No. 194 BARNES Vertical Hone, 4" Capacity, 12" Stroke, M.D.

12" PRATT & WHITNEY Vertical Shaper, Keller Attachment. Late Type.

8" CLEVELAND Model A Automatic Screw Machine, Late Type.

MP-9C SIP Swiss Jig Borer, 15" x 20½" table, Excellent condition, A.C. Motor Drive.

OVER 1000 MACHINE TOOLS AVAILABLE IN STOCK . . . SEND US YOUR INQUIRIES

IMMEDIATE DELIVERY
BRAND NEW
CYRIL BATH

POWER PRESS BRAKES

₤150-8	8' x 5/16"	10' BED
₤150-10	10' x 1/4"	12' BED
₤150-12	12' x 3/16"	14' BED

PRESS & SHEAR MACHINERY CORP.
2600 EAST TIOGA STREET
PHILADELPHIA 34, PA.
GArfield 6-8840

½" & 1¼" BSA Automatics, 1954.
Gleason 3" Str. Bevel Generators.
No. 2 Press-Rite Presses, air clutch.
Fellows No. 4 Fine Pitch Shavers.

D. E. DONY MACHINERY CO.
4357 St. Paul Blvd., Rochester 17, N. Y.

HILL-CLARKE

BEST BUY OF THE MONTH

BEST BUY OF THE MONTH

No. 314-A Baker Universal Quick Change Heavy Duty Drill, 15HP 220/440-3-60 motor drive, reversing spindle for tapping, 6" raising block, swing 24½", spindle travel 15", max. distance spindle to table 40½", extra large steel table 27" x 48¼", table travel 18", spdl. speeds 43-232 R.P.M., 3" capacity in steel, coolant, 24 geared feeds—.005 to .008, Serial 13057 (1943). Price $4,500.00.

PARTIAL LISTING

BORING MACHINES

Foote-Burt Vert. 26" sw. new 1941
#49 Heald Borematic, new 1946
8½" Bar Cinn.-Gilbert Floor Type

DRILLS

1 spdl. 14" sw. #3 Avey, new 1946
1 spdl. 20" sw. #2LMB L-G, 1946
1 spdl. 24" sw. #2MA6 Avey, new 1943
1 spdl. 26" sw. #4MB L-G hydraulic
2 spdl. 24" sw. #3 Avey, AC MD
3 spdl. 26" sw. #2LMB L-G, 1942
3 spdl. 24" sw. #2MB L-G, new 1943
6 spdl. 20" sw. #1LMB L-G, new 1943
#314-A Baker Univ. H.D., 1943
16 spdl. Fox #K60H, #2 taper, 1946

GRINDERS

2"x12" #5 B&S, 1942
3"x18" #5 B&S, 1943
4"x12" #4H Landis, New 1942
6"x18" Norton Type C, new 1943
10"x16" Norton Type C, new 1941
10"x36" Norton Type C, new 1943
10" (28" sw.) x 48" Cinn. EB, 1943
10"x36" Hill-Clarke, AC Mot. Dr.
10"x72" Hill-Clarke, AC Mot. Dr.
10"x96" Hill-Clarke, AC Mot. Dr.
10"-20"x36" Norton, angular wheel
14"x72" Norton Type C, new 1941.
14"x96" Hill-Clarke, A.C. Mot. Dr.
16"-20"x96" Norton, 1942
16"-40"x96" Norton Gap, 1942
16"x72" Hill-Clarke, A.C. Mot. Dr.
16"-26"x72" Norton, AC MD 1941
18"x96" Hill-Clarke, AC Mot. Dr.
18"x120" Norton, AC MD.
20"-32"x144" Norton Pl. Cyl.
23"x36" Norton, Hi-Swing
24"x264" Norton, AC MD
42"x72" Norton, extras, new 1947
#5A Bryant Internal, new 1943
#16A-16 Bryant Internal, new 1943
#16-36 Bryant Internal, new 1941
#24-26 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#72A3 Heald Int. Micromatic, 1944
#72A5 Heald Internal, new 1943
#72A6 Heald Bridge Type Int.
#214 Besly Double End Disc. 1940
2B Abrasive Surf. 6"x24", 1943
#18-30" Blanchard Rot. Surf.

LATHES

16ML-16"x36" LeBlond Auto.
12"x30" Hendey Lathe, Taper Att.
12"x29" Lipe Carbo Semi-Auto
12"x32" Fay Automatic
12"x45" Fay Automatic
14"x36" Amer. Grd. Hd., MD
27"x84" Amer. Grd. Hd., MD
24"x42" Fay Auto. AC MD
36"x120" Putnam Grd. Hd., MD
R14 Seneca Falls, 16"x36", 1942
120"x96" or N-B-P, ser. 3580
#5W Cinn Acme Univ. Turret
#4 Gisholt Univ. Tur. A.C.&B.F.
#3H-10 Libby H.D. Tur. 1943
#4A W&S Turret Ser #38000
4FU Fastermatic, tur. 32" sw. 1944
8D Potter & Johnston, new 1941

MILLERS

54"x30"x10' Ingersoll Slab, 1934
54"x60"x8' Ingersoll Openside, 1943
54" Ingersoll Vertical Rotary
Davis & Thompson Vert. 1944
#12-B Pratt & Whitney Profilers
10"x60" F&W Mod. B. Thread Mill
#LT 6"x72" L-B Thread Mill
#HT 12"x24" L-B Thread, 1942
#CT 24"x36" L-B Thread, 1942
No. 2 Cinn. Univ. Hi-Power
#118 Van Norman Prod. 1943

PLANERS

36"x36"x12' Rockford Openside '42
60"x48"x12' American, 4 hds.
60"x48"x36' Hamilton, 4 heads

MISCELLANEOUS

6" Goss & DeLeeuw 8 spdls. 1941
#306 Barnes Vert. Hone, new 1942
#111RD 3 Hd. W&S Tapper, latest
#36BM G&E 8 Spdl. Bevel Gear
612-A Fellows Gr Shaper 18" cap.
#HK8 Barber-Colman Sharp Mach
15 Ton Toledo Overhd. Crane, 39½

PHONE: CRawford 7-2000

HILL-CLARKE MACHINERY COMPANY 2106 S. KILBOURN AVE., CHICAGO 23, ILL.

SEARCHLIGHT SECTION

Eastern Rebuilt Machine Tools

THE SIGN OF QUALITY — THE MARK OF DEPENDABILITY

SURFACE GRINDERS

No. 16 Blanchard Rotary, m.d.
No. 16A-2 Blanchard Auto. Rotary, m.d.
No. 2B Brown & Sharpe, m.d.
No. 33 Abrasive, m.d.
14" Pratt & Whitney Vertical, m.d.
14" Pratt & Whitney Model M 1640 Vertical, m.d.
No. A-1-8" Arter Surface Grinder
No. 22—12" Heald Rotary, m.d.
No. 25-A-24" Heald Rotary, m.d.
No. 25-A-30" Heald Rotary, m.d.
No. 2 Brown & Sharpe, m.d.
#300-60 Hanchett Vertical Spindle, m.d.
78" Type NT Rogers Knife Grinder, m.d.
16"x24"x120" Mattison, m.d.
Model T Builders Iron Foundry, m.d.

PLAIN CYLINDRICAL GRINDERS

No. 2 Brown & Sharpe Plain Cylindrical, m.d., 1943
6x15" Cincinnati Plain Hydraulic, m.d.
6x18" Cincinnati Model EA, m.d.
6x18" Cincinnati Model ER, Plain Hydraulic, m.d., Filmatic Spindle
6x18" Landis Type C Hydraulic, m.d., late
10x19" Cincinnati Plain Hydraulic, Model ER, m.d., Filmatic Spindle, 1943
10x19" Cincinnati Model EA, m.d.
10x19" Norton Type C, m.d., latest
10x36" Cincinnati Hydraulic, m.d.
10x36" Norton Type C, m.d.
10x72" Landis, m.d.
12x36" Landis Plain Self-Contained, m.d.
12x96" Landis Plain Self-Contained, m.d.
14x52" Norton, motorized
16x72" Landis Plain, m.d.
10x72" centers Type C Norton Semi-Auto., Hydraulic
16x96" Cincinnati Plain Cylindrical, m.d.
10" raised to 20" size x 72" centers Norton, Type C, m.d.
18"x72" Norton Type C, mechanical m.d.
20"x120" Landis Plain Self-Contained, m.d.

UNIVERSAL GRINDERS

No. 2 Brown & Sharpe, 14"x30" centers cap., m.d.
No. 3 Brown & Sharpe, 14"x30" centers cap., m.d.
10x24" Landis Type C, m.d.
12x48" Norton Universal, m.d., latest
14x48" Landis Universal
18x60" Landis Universal, m.d., Type C

HONING MACHINES

No. 3 Barnes Single Spindle Horizontal Internal Hone, new
No. 182 Barnesdrill, m.d.
No. 854 Micromatic Vertical Honing Machine, m.d.
H1 Micromatic Horizontal Hydrohoner, m.d.
H4 Micromatic Horizontal Hydrohoner, m.d.
No. 6 Barnes Twin Spindle
No. 306H Barnes Single Spindle
No. 224B Barnes Honing Machine, m.d.

THREAD GRINDERS

No. 33 Excello Precision, m.d.

INTERNAL GRINDERS

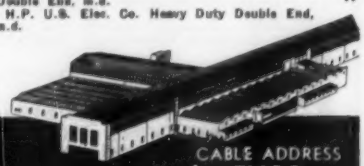
Type 1G 103 Greenby, m.d.
No. 5 Bryant, m.d., latest
Model 5Y Bryant, m.d.
No. 16—16" Bryant, m.d., hydraulic Hole Grinder
No. 16CH16 Bryant, m.d., latest
No. 16—22" Bryant, m.d., latest
No. 16—36" Bryant, m.d., latest
No. 16A-16 Bryant Hole & Face, m.d.
No. 16-A-28" Bryant, m.d.
No. 24-36 Bryant Hole & Face Type, m.d., late
No. 24P—20" Bryant, m.d.
No. 24—21" Bryant, m.d.
No. 24-L-36 Bryant, m.d., late
No. 24-LW-36 Bryant, m.d., late
No. 44 Heald Facing Type Borematic, m.d.
No. 47A Heald Borematic, m.d.
No. 649—16" Van Norman Automatic Oscillating Radius, m.d., latest
No. 70 Heald, motorized 3 motors
No. 70A Heald, m.d., latest
No. 72A Heald Sizematic, "Duplex", m.d.
No. 72A Heald Gagematic, m.d.
No. 72A3 Heald Gagematic, m.d.
No. 72A3 Heald Sizematic, m.d.
No. 72A3 Heald Plain, m.d.
No. 72A5 Heald Sizematic, m.d.
No. 72A5 Heald Plain, m.d.
No. 73 Heald Airplane, m.d., latest, new
No. 74 Heald, m.d.
No. 74 Heald, Plain Long Base, m.d., 1941
No. 75A Heald, m.d., latest
No. 78 Heald Centerless Cylinder Grinder, m.d.
No. 81 Heald Gagematic, Sizematic, m.d.
No. 81 Heald Plain & Sizematic, m.d.

PUNCHES & SHEARS

No. 7 Thomas Vertical, latest
No. 6½ Hilles & Jones Punch & Shear, single end, type "G"
Cleveland Type G Vertical Shear, 72" throat, m.d.

SNAG GRINDERS

Type No. 50—7½ H.P. Standard Elec. Tool Co. Double End, m.d.
25 H.P. U.S. Elec. Co. Heavy Duty Double End, m.d.



SEND FOR COMPLETE STOCK LIST

THE EASTERN MACHINERY COMPANY
1004 Tennessee Avenue, Cincinnati 29, Ohio — MElrose 1241 — CABLE ADDRESS EMCO

EXCELLENT USED MACHINE TOOLS

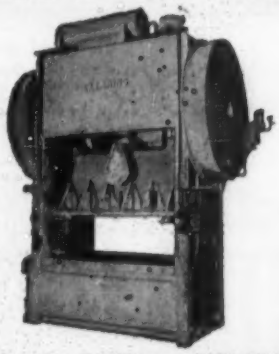
No. 5 Abrasive 12"x60" surface grinder, horiz spdl.
No. 2 Standard Brown & Sharpe vertical mill, new 1943.
No. 3 Gisholt ram type universal turret lathes (2), new 1942.
No. 5 Gisholt ram type universal turret lathe, new 1940. Arr. bar & chucking.
Model BL2416 F & W Keller machines (2) one late
14" x 42" cc Hendey toolroom engine lathe, new 1940.
No. 5-48 Cincinnati hydromatic duplex mill, late
No. 4 Cincinnati high-power plain horizontal mill, serial E506J.
No. 4 Gallmeyer & Livingstone universal tool & cutter grinder, new 1941.
5' arm 13" col. Fosdick "Economax" hydraulic radial drill, new 1943.

Free Illustrated Catalog of 1000 Machine Tools

MILES MACHINERY COMPANY
2039 E. GENESEE AVE.
SAGINAW, MICHIGAN
Telephone 2-3105

WORLD'S LARGEST STOCK STAMPING PRESSES

BLISS • CLEARING • CLEVELAND
FERRACUTE • HAMILTON • L & J
NIAGARA • TOLEDO • V & O



SQUARING SHEARS • PRESS BRAKES
REBUILT and GUARANTEED

JOSEPH HYMAN & SONS
TIOGA, LIVINGSTON & ALMOND STS.
PHILADELPHIA 34, PA. Phone GArfield 3-8700

McDONALD USED MACHINERY

New Britain Model 16 Auto. Chucker 6-Sp.
Bridgeport Vert. Miller with Shaping Attach
Brown & Sharpe No. 2 Surf. Grinder All Motorized
G&L 9" Bar Table Type Horiz. Boring Mill
Colburn 2-Spindle Bar Col. Heavy Drill M.D. 20"
Niles (Timesaver Model) 32"x14' Bed Grd. Hd. M.D. Lathe 7' Centers.
Niagara 4' Power Shear ¼" Cap. 20° Gap
Ohio 24" M.D. All Grd. Feeds Shaper 1942 model
Cincinnati No. 8 Rect. Overarm Grd. Hd. Plain Horiz. Miller.
Baush 44" Vert. Boring Mill 2 heads.
American Vert. Hyd. Broach 40" str. 15 ton cap. 1947
American 20"x8' Grd. Hd. Lathe motor in base.
Landis 20"x72" and 18"x96" Plain xt. Grinder.
Hanchett 25 H.P. Sp. Vert. Hydr. Surf. Grinder 12"x48" table
W&S No. 2-A Grd. Hd. Univ. Turret Lathe
Bliss 200 T Cap. S.S.S.C.B. Grd. Press 8" Str. #77
Rivett No. 104 A.C. M.D. Internal Grinder, 1942.
Milwaukee Nos. 2-B & 3-B Horiz. Plain Millers.
DoAll 16" Jeb Selector Metal Saw, 1950 Model.
Cincinnati 36"x36"x10' D.H. Planer 2 Hds. Box
Amer. 6' Radial Ensl. Hd. 16" Col. 32-Sp. Speeds.
Amer. 4 Radial 12" Col. Ensl. Hd.
Bliss #6N S.C. Stiles Type Press
Cincinnati No. 2 Hi-Power S.P.D. Vert. Miller.
B&S #2A Grd. Hd. Horiz. Univ. Miller.
Barnes 20" All Grd. Camel Back Drill 1-Sp.
Blanchard M.D. Vert. Sp. Surf. Grinder 26" chuck.
Sundstrand 4-Sp. Vert. Rigidmill.
Heald #22 Rot. Surf. Grinder 12" chuck 1942.
Landis 2-Sp. 2" Cap. Bolt Threader M.D.
Hendey 18"x8' bed G.C.G. Lathe 1939.
G & E 24" Gear Box Shaper Tilt. Table Top.
Newton 48" Table 1-Sp. Cont. Vert. Miller.
Foster 2-F Fastermatic Hyd. Turret Lathe.
Kempsmith No. 2 Vertical Maximiller M.D.
P & J #2 Auto. Prod. Miller, 2 Tables.
Cincinnati #2, #3 & #4 Centerless Grinders, all Motor Driven.
Bullard 24" Vert. Turret Lathe.
Lynd-Forcubar 28" stroke open-side Shaper Planer.

MONA MEMBER
McDONALD MACHINERY CO.
1531-35 No. B'way., St. Louis 6, Mo.

FOR SALE

#4 Cincinnati Centerless Grinder #3M4H1K (Filmatic)
#35L Excello Thread Grinder #1383
#30A Excello Internal and External Thread Grinder #5185
Sundstrand Plain Duplex Milling Machine, Model #35FM10120, Ser. #98-268 (10 ft. table). Write
ALBERT TOOL & GAGE CO.
2301 Harrison — Kansas City 8, Mo.

FOR SALE

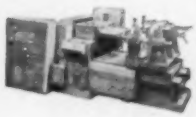
Keller Duplicator GG 1210
Bryant Hydraulic Internal Grinder 16-A-16
J. G. TILP, INC.
Milltown Rd. — Union, N. J.

ROLL FORMER WANTED!

30" between housing
2" Dia. Shaft—6 Stands
Age of Machine Secondary
AAA PRODUCTS COMPANY
Allen & Bristol Sts., Phila. 37, Pa.

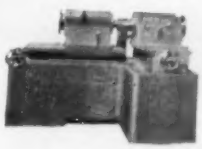
SEARCHLIGHT SECTION

LAURENS - LAURENS - LAURENS - LAURENS



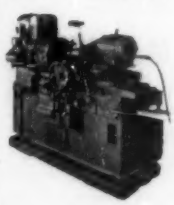
1—No. 521 Heald Single End Boramatic, new about 1950, 16" table travel, practically new.

LAURENS - LAURENS - LAURENS - LAURENS



1—No. 20 Gleason Spur Gear Tester, complete with four-speed pinion head drive motor, outboard support bracket.

LAURENS • LAURENS • LAURENS • LAURENS



No. 72-A-3 HEALD

Sizematic Hydraulic Semi-Automatic Precision Internal Grinder.

LAURENS

Our customers like our way of dealing—so will you. But, of course, you will have to know us first. We are known from Sweden to Australia as dependable dealers with technical knowledge. If it's quality and the reputation of your dealer which counts with you, that is what we sell; anybody can sell just machines. Send us your inquiries since this ad contains only just a few random examples from our large stock.

Tools Machine

LAURENS BROS., INC.
2780 HIGHLAND AVE.
CINCINNATI 12, O.

LAURENS - LAURENS - LAURENS - LAURENS

1—No. 13 Gleason Universal Gear Tester, for high precision "hand rolling" gear testing.

LAURENS - LAURENS - LAURENS - LAURENS

No. 4H Barnes Hydrom, Hydraulic feed, quick change speeds, in and out table. For single spindle and multiple drilling. Similar to illustration.

LAURENS • LAURENS • LAURENS • LAURENS

Model No. 74 HEALD Hydraulic

"Long Base" "EXTENDER BRIDGE" Precision Grinder, for work pieces too long to be handled by standard length machines. Late style, perfect condition, complete with extras.

PRACTICALLY NEW PRESSES

Bliss No. 7-84, cap. 200 ton, Bed 50"x84".
Bliss No. 9-96, cap. 400 ton, Bed 96"x96".
Niagara No. 610E, cap. 180 ton, Bed 72"x42".
Bliss No. 3½-45W, cap. 120 ton, Bed 48"x30".
Bliss-Toledo No. 83½3, cap. 140 tons, Bed 108"x 48".
Bliss 9½ H, Bed 84"x30", cap. 140 tons.
Bliss No. 27-94, Gap Frame, cap. 200 ton, Bed 24"x108".
Cleveland No. 65D96, cap. 180 ton, Bed 96"x48" str. 8".

All Machines have Air Clutch and some have Air Cushions and Motor Driven Ram Adjustment. Still set up in Plant
"If it's machinery, we have it."

NATIONAL MACHINERY EXCHANGE
138 Mott St., N. Y. CAnal 6-2470

HD MACHINE TOOLS

Serving the World's Largest Manufacturers

#42 Heald Two Spindle Single End Boramatic Serial #11137.

Late Type No. 2 Cincinnati Dial Type Universal High Speed Miller Serial 4A2U1P-58

48" x 48" x 12" Cleveland Heavy Duty Openside Planer

#500 Hanchett Vertical Surface Grinder Serial #500-17.

NEW USED REBUILT MACHINERY

MONA MOTORS

HAZARD BROWNELL MACHINE TOOLS INC.
350 WATERMAN STREET PROVIDENCE 6, R. I. DEXTER 1-8880

BENNETT MACHINERY CO.

BORING MILLS 4" Sellers, T'ble Type, Late 4½" & 4" bar Sellers Floor Type
3" bar Universal, Triway, T'ble Type
10" & 10"-16" Niles Vert. Mills
61" Bullard Maxi-Mil, 2 Rail Hds.
52" King, 2 Rail Hds., P.R.T., M.D.
53" Niles, 2 Rail Hds.; P.R.T.; M.D.
36" & 24" Bullards, Spiral & New Era (3)
GRINDERS No. 36 Hanchett 30" vert. Rotary '44
30" Blanchard No. 16 Vert. Rotary
36"x42" Pratt & Whitney Vert. Surf. '47
60" Hanchett Vert. Spin. Surf. No. 380. Rec. 16"x20" B. & S. No. 1 Univ. '42
LATHES 28" x 48" con. LeBlond, 31" sw. '41
TURRETS Nos. 3AL, 2L, 5 & 3 Gisholts
Nos. 2 W. & S. & 2 & 2G Moreys
MILLERS No. 2 Cincl. Dial Type Univ. '45
No. 4B K. & T. Vert.—Table, 102"x19" oversize
RADIAL DRILLS 3'11" Bickford, new 1950 & '54 (2)
3'9" Amer. Hole Wizard, new 1942

375 Allwood Rd. Clifton, New Jersey
Phone: PArkway 4-4700 N. Y. Phone: LOngacre 3-1222

CHOICE MACHINE TOOLS

CINN 5-60 Prod. Mill 1944
K&T 1404 Prod. Mill 1943
CINN 1-18 Prod. Mill 1951
SUNDSTRAND #1 Rigidmil 1954
TOCCO 200 KW, 3,000 cy. 1943
TOCCO 60 KW, 10,000 cy. 1943
GISHOLT #3, Air Chuck & Cyl. 1943
GISHOLT 1L, bar feed, C.S. turret, 1943

BULLARD 42", VTL Side Head
LAPOINTE, Vert. Broach 20T, 90" st. 1941
CINN. Cyl. Grinder 8x18 Plunge 1945
CINN. Cyl. Grinder, 10x16 Plunge 1941
CINN. Cyl. Grinder, 18x72 Plunge 1948
CINN. number 2 cyl; Grinder Fimatic 1944
NORTON Cyl. Grinder, 6x18 Plunge 1944
HANCHETT #900 Face Grinder 1944
ROCKFORD Hyd. Vert. Shaper, 12" st. 1944
GRAY DH Planer, 60x60x12, 4 heads, DC drive
BETTS DH Planer, 84x84x16, 4 heads DC drive
SOMMER & ADAMS Thread Mill, 18", H.I.S. 1948
BIGNALL & KEELER 8" pipe threader, 1949
BIGNALL & KEELER 12" pipe threader, 1949
BLISS 812 W, SSSC, 565 Tn, 14" stroke, 42"x50" bed, 1947

NOLL EQUIPMENT CO.
4835 St. Clair Ave., Cleveland 3, O.
EXpress 1-0700

FOR SALE

MACHINE TOOL BUILDERS OFFER LINE OF RAM TYPE TURRET - VERTICAL MILLING MACHINE.

Sale to consist of the entire business or any portion wanted as listed below:

Patterns, prints, jigs and fixtures, machine parts and assemblies, and rights to our milling machine line.

The line is well established throughout the United States by reputable dealers supplying us with a back log of orders.

BO-3285, AMERICAN MACHINIST
Classified Adv. Div., PO Box 12, NY 36, NY

If there is anything you want that other readers can supply
OR . . . something you don't want— that other readers can use—
ADVERTISE it in the SEARCHLIGHT SECTION

SEARCHLIGHT SECTION

FOR SALE

MODERN MANUFACTURING FACILITIES AVAILABLE IN OUR MACHINED PARTS DEPT.

Monarch Air Tracer Lathe 20" & 14" (Shaft Work Up To 14 x 20 Contour Turning 28" Diameter)
Hendy & Monarch Engine Lathes
Internal & External Grinders
Duplicating, Pantograph, Drilling & Milling Equipment

J. G. TILP, INC.
SPRINGFIELD & MILLTOWN RD.
UNION, N. J.

LARGE LATHE

60" x 45' or 70' C.C.

Mackintosh-Hemphill, New 1943, 62' Bed, Heavy Duty, 2 M. D. Carriages, Geared Head, Screw-Cutting, 60" Face Plate, 3 Steady Rests, Additional 25' Bed Section Allowing 70' Centers, Wt. Approx. 160,000 lb.

Republic MACHINERY COMPANY
THOS. J. O'BRIEN, PRES.
WAlnut 2-8818

WANTED

WANTED

Seeking Davenport auto. lathes type B oversize or regular, maximum space (gap) 3½. Write to "Agence Havas" No. 215/598 Rue Vivienne 17, Paris.

WANTED — USED MACHINERY

5" or 6" Bar Floor Type Horizontal Boring Mill 1940 or Later
72" or 84" x 18 Planer—Reversing Motor Drive.
Large Rotary Index Table—25 ton capacity. 15' x 20' Floor Plate.

R. A. JENKINS
P. O. Box 6910 Philadelphia 32, Pa.

BOOKS

"Key to Preventive Maintenance"
MACHINE TOOL RECONDITIONING
& the Art of Hand Scraping (new 2nd printing) —useful for design, shop & inspection work— Write for folder describing illustrated book.
MACHINE TOOL PUBLICATIONS
215 Commerce Bldg., Fourth & Wabash Sts.
St. Paul 1, Minn.

New "SEARCHLIGHT" Advertisements

received by Jan. 15 will appear in the Jan. 28 issue, subject to space limitations.

Classified Advertising Division

AMERICAN MACHINIST
P.O. Box 12,
New York 36, N. Y.

PLANT SUPERINTENDENT

Well established heavy machinery organization has opening in Middle Atlantic States for man with supervisory experience in weldment and metal fabrication of heavy industrial equipment. Must be completely familiar with plant operation, production control, production engineering and capable of directing the activities of a plant fully staffed with the latest heavy fabricating equipment.

Extensive benefit program and salary commensurate to background and experience. Please submit complete resume including salary requirements to:

P-3838, AMERICAN MACHINIST
Classified Adv. Dept.
P.O. Box 12, New York 36, N. Y.

DO YOU MAKE A QUALITY LINE

supported by good engineering and manufacturing facilities? Well established firm of experienced sales engineers covering all six New England states, representing many of the country's blue chip machine tool manufacturers, is open for a few additional accounts. Wide experience in sales engineering. Warehouse facilities. Showroom. Write

RA-3764, AMERICAN MACHINIST
Class. Adv. Div., P.O. Box 12, New York 36, N. Y.

REPLIES (Box No.) Address to office nearest you c/o this publication Classified Adv. Div.
NEW YORK: P. O. Box 12 (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITION VACANT

Machine Shop Assistant needed by medium sized heavy process machinery manufacturer. Young college engineer graduate with some experience preferred. Position has a future. First duties will cover rate setting, carbide tool development and assist in increasing productivity. Company has liberal profit sharing plan. Salary open. Location S.E. Penna. Reply P-9590, American Machinist.

SELLING OPPORTUNITY WANTED

Well-established Cleveland firm of sales engineers, operating throughout northern Ohio, presently representing nationally known machine tool manufacturers exclusively, open for one additional account. We offer considerable experience, versatility, and competence in sales engineering, with thorough knowledge and coverage of territory. Interested only in American quality line backed by good engineering and manufacturing facilities. Write RA 3439, American Machinist.

EMPLOYMENT PROBLEM?

When you are in need of specialized men for specialized jobs, contact them through an employment ad in this publication.

Answers to hundreds of METALWORKING questions —on planning and production— COMPLETE IN ONE EASY-TO-USE VOLUME

What leading magazines say about this book

AUTOMATIC MACHINING: "Offers quick answers to metalworking problems of a practical nature."

DESIGN NEWS: "Digests essentials of a vast amount of original source material that would otherwise prove difficult to obtain even when one knows where to look."

WELDING JOURNAL: "A valuable aid to machinists, designers, draftsmen, and engineers."

MECHANICAL ENGINEERING: "Emphasis throughout is on up-to-fateness, comprehensiveness, and practicality."

AUTOMOTIVE INDUSTRIES: "Provides a storehouse of useful tables and formulas, plus a convenient-sized encyclopedia of up-to-the-minute information on modern metalwoking methods, material, and equipment."

MANAGEMENT DIGEST: "Completely new and truly up to date."

PRODUCT ENGINEERING: "As a reference handbook, as a volume for self-study, as a practical summary of man's up-to-date methods of working metal, this complete revision of Colvin's and Stanley's original handbook should prove valuable to all those active in the manufacturing process."

The NEW AMERICAN MACHINIST'S HANDBOOK

45 SECTIONS

Part I. MACHINING METHODS—1. Broaches and Broaching. 2. Drills and Drilling. 3. Files and Burrs. 4. Gears, Splines, and Serrations. 5. Grinding, Honing, Lapping, and Superfinishing. 6. Milling and Milling Cutters. 7. Planing and Shaping. 8. Reamers and Reaming. 9. Saws and Sawing. 10. Threading Processes and Thread Systems. 11. Taps and Tapping. 12. Turning and Boring. 13. Screw-machine Work.

II. METAL-FORMING METHODS—14. Metal Spinning. 15. Pressworking and Cold-roll Forming. 16. Forging, Upsetting, and Cold Heading. 17. Cold Working of Metals. 18. Die Casting. 19. Babbitting of Bearings.

III. ASSEMBLY METHODS—20. Arc Welding and Surfacing. 21. Gas Welding and Oxygen Cutting. 22. Resistance Welding. 23. Brazing. 24. Soldering and Soft Solders.

IV. MATERIALS—25. Steels and Irons. 26. Non-ferrous Metals. 27. Heat-treatment of Metals. 28. Gages, Tolerances, and Weights of Metal Products.

V. FINISHING OF METALS—29. Metal-cleaning Processes. 30. Plating and Metal Coating. 31. Paint and Painting. 32. Electrolytic and Chemical Finishes of Metals.

VI. INSPECTION—33. Limits, Fits, and Tolerances. 34. Measuring and Gaging Equipment. 35. Tapers and Dovetails.

VII. FASTENING DEVICES — 36. Bolts, Screws, Rivets, and Washers. 37. Keys and Pins.

VIII. TOOL ENGINEERING AND DRAFTING PRACTICE—38. Jig and Fixture Details. 39. Drafting Practice and Engineering. 40. Surface Finish.

IX. MACHINE-TOOL STANDARDS — 41. Standard Machine-tool Elements. 42. Machine-tool Inspection.

X. POWER-TRANSMISSION EQUIPMENT—43. Chain, V-belts, and Motors.

XI. MATHEMATICS AND TABLES—44. Mathematics. 45. Reference Tables.

Edited by RUPERT LE GRAND

Senior Associate Editor, **American Machinist**

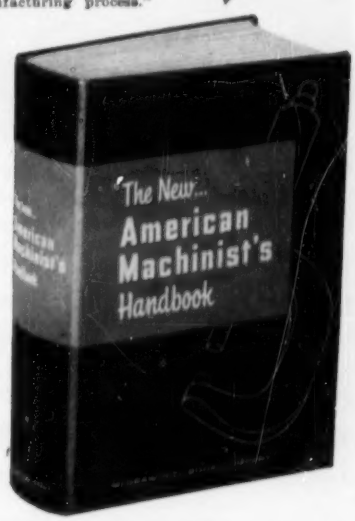
1579 pages, 5¾ x 8,

774 illustrations, $11.00

- **80% REWRITTEN**
- **REARRANGED TO GIVE MORE FACTS—EASIER REFERENCE**
- **FULLY UP TO DATE**

Here is a treasury of the kind of machine shop information that will help every man to save time and avoid trouble in his own work, to go ahead on any job with confidence, and to improve his skill, reputation, and earning power. And, overall, the shop benefits, too, in time saved in set-up and operation, in reduced delays and spoilage, and in improved results.

Just think of being able to find the answer—the dependable answer — to almost any question — quickly — layouts, feeds, speeds, tools, jigs, fixtures, materials, standards, tolerances—any detail of machine shop or drawing room practice. The New American Machinist's Handbook presents this kind of information, in the form in which you can best understand and use it.



As the English journal, **Machinery Lloyd says**, "So vast in its scope and wide in its coverage that it is difficult to do it justice in a short space." Get the best measure of the book's worth for you from the book itself. Send for it, without obligation, for free examination.

SEE THESE BOOKS FOR 10 DAYS FREE — JUST SEND THIS COUPON

INDUSTRIAL ENGINEERING HANDBOOK

Puts a wealth of dependable information at the fingertips of industrial engineers and management men. Covers all aspects, from materials handling, job evaluation, work measurement, and plant facilities and design, to automation, and linear programming. Factual and how-to-do-it in approach. Prepared by over 70 specialists. H. B. Maynard, Editor-in-Chief. 1512 pages, illustrations, $17.50

HANDBOOK OF FASTENING AND JOINING OF METAL PARTS

Ready reference guide helps in selecting best methods for specific jobs of fastening, joining, and connecting metal parts for assembly. Covers such methods as screw thread and nuts, welding, collars, couplings, keys, brazing, soldering, resins, adhesives, etc. An outstanding feature is the easy-to-follow 200-page section in picture and caption style. By V. H. Laughner and A. D. Hargan. 622 pages, over 3,500 illustrations, $15.00

McGRAW-HILL BOOK CO., INC., Dept. AM-12-31
321 W. 41st St., New York 36, N. Y.

Send me book(s) checked below for 10 days' examination on approval. In 10 days I will pay for book(s) I keep, plus few cents for delivery costs, and return unwanted book(s) postpaid. (We pay delivery costs if remittance is sent with this coupon; same return privilege.)

- ☐ Le Grand—New Amer. Mach. Handbook, $11.00
- ☐ Maynard—Industrial Eng. Handbook, $17.50
- ☐ Laughner & Hargan—Hdbk. of Fasten. & Join. Metal Pts., $15.00

(Print)
Name .....
Address .....
City & Zone ..... State .....
Company .....
Position .....

For prices & terms outside U. S. write McGraw-Hill Intl. N. Y. C. AM-12-31

INDEX OF PRODUCTS ADVERTISED IN THIS ISSUE

Accessories & Attachments (Machine Tool) ..... 2nd Cover, 20, 30-31

Books, Technical ..... 3rd Cover

Boring, Drilling & Milling Machines (Horizontal) 14-15

Boring Machines Internal ..... 2nd Cover, 50

Broaching Machines 26-27

Cams 142

Centering Machines 153

Centers, Live 137

Centrifugal Machines 144

Chucks 30-31, 129, 131

Cleaning & Drying Machines & Supplies 144

Collets 52, 131

Cut-Off Machines 128

Dressers 137

Drilling Machines 40-41, 127, 145

Drill Jig Bushings 50

Dust Collectors 139

Engineering & Production Services 141

Fabricating Methods & Services 141

Fasteners 32

Gages, Instruments & Testing Equipment 24-25, 39, 46-47, 125, 132, 136, 142, 143

Gear Cutting Machines 3, 6-7, 154

Gears, Speed Reducers, Motor Reducers 140, 143

Gear Testers 3, 6-7

Grinders—Cutter & Tool 97, 133

Grinding Machines—Production 8-9, 12-13, 16-17, 18-19, 21, 36-37, 38, 100

Grinding Wheels 21

Heads: Drilling, Grinding & Tapping 142

Hydraulic & Pneumatic Parts & Equipment 135

Jig Borers 127, 153, 155

Jigs & Fixtures 131, 141

Keyseaters 142

Lathes, Engines 33, 35

Lathes, Turret 22-23

Lubricants, Cutting Fluids, Quenching Oils & Solvents 58

Marking Machines, Tools & Supplies 44

Materials, Cutting & Forming ..... 4th Cover, 46-47, 102, 104

Materials of Manufacture ..... 4th Cover, 43, 62, 102, 104

Materials Handling Equipment 130

Millers, Die Sinkers, Profilers 4-5, 153, 155

Motors, Electrical 54

Oil Purifiers 144

Planers 14-15, 28-29

Power Transmission 142, 156

Presses, Forging & Forming Equipment & Supplies 48, 98, 135, 156

Pumps, Circulating 144

Riveting Machines 154

Saw Blades 46-47

Sawing Machines 128, 142

Screw Machines; Chucking Machines 61, 134

Shapers & Slotters 64

Special Machine Tools 34, 138-139, 141

Steel Blue 142

Tapping Attachments 131

Tapping Machines 40-41

Thread Cutting Machines 10-11

Thread Rolling Machines & Tools 10-11, 45

Tools, Cutting ..... 3rd Cover, 42, 142

Tools, Hand 20

Tools, Measuring 46-47

Used & Surplus Equipment 146-151

Vises 20, 155

INDEX TO ADVERTISERS

This index is published as a convenience to the readers. Every care is taken to make it accurate, but AMERICAN MACHINIST assumes no responsibility for errors or omissions.

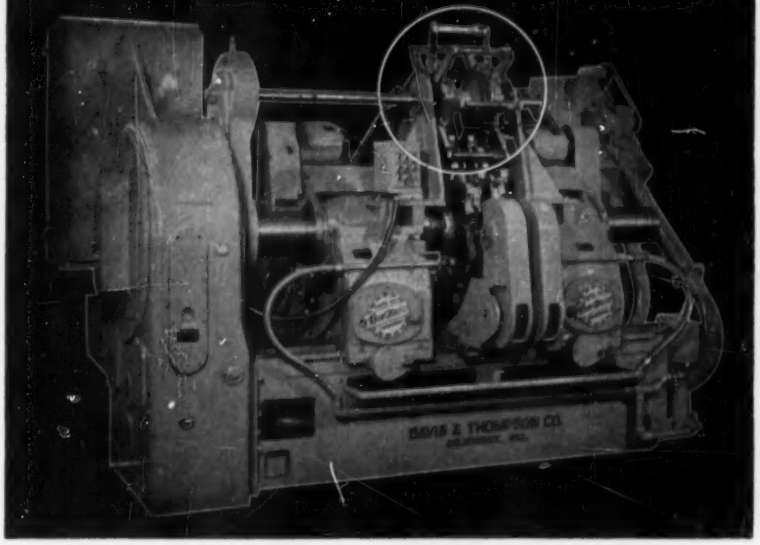
	Page
Alvord-Polk Tool Company	142
American Brass Company	43
American Chain & Cable Company, Inc.	130
American Machinist	56-57
American Tool Works Co.	33
Armco Steel Corporation	62
Armstrong Brothers Tool Company	20
Barrett Co., Leon J.	144
Blanchard Machine Co.	38
Bryant Machinery & Engineering Co.	127
Cincinnati Gilbert Machine Tool Co.	145
Cincinnati Grinders Incorporated	16-17
Cincinnati Milling Machine Co.	4-5
Cincinnati Shaper Company	64
Cleereman Machine Tool Company	127
Cleveland Punch & Shear Works Company	156
Columbus Die-Tool & Machine Co.	141
Cone Automatic Machine Co.	61
Copperweld Steel Company	102
Danly Machine Specialties Inc.	48
Davis Keyseater Company	142
Davis & Thompson Co.	153

INDEX TO ADVERTISERS

	Page
Delta Power Tool Div. Rockwell Mfg. Co.	35
DoAll Company	128
Dykem Company	142
Eastern Machine Screw Corporation	142
Eastman Kodak Co.	125
Eisler Engineering Co., Inc.	142
Elliott Myers Corporation	142
Erickson Tool Co.	131
Ex-Cell-O Corporation	50
Extremultus Inc.	142
Fellows Gear Shaper Company	6-7
Gardner Machine Company	21
Giddings & Lewis Machine Tool Company	14-15
Gleason Works	3
Goss & DeLeeuw Machine Company	134
Grant Gear Works Inc.	143
Grant Mfg. & Machine Company	154
Gray Co., G. A.	28-29
Hamilton Tool Company	154
Hardinge Brothers, Inc.	52
Heald Machine Co., Sub. Cincinnati Milling Machine Co.	2nd Cover
Hirschmann Company, Carl	133
Hydraulic Press Mfg. Co., Div. of Koehring Co.	135
Ingersoll Milling Machine Co.	97

(*Continued on page* 154)

...Milling and Centering Steering Gear Shafts at the Rate of 360 Per Hour



This continuous type milling and centering machine has been furnished with an automatic unloader (indicated by circle) which transfers finished parts onto a conveyor or discharge chute. Milling and centering of both ends is done simultaneously and in continuous production.

Basically, this is a standard ROTO-MATIC machine tooled-up to handle special production requirements. Rough and finish milling and centering spindles in both heads have micrometer endwise adjustment. Heads are adjustable on the ways. With equalizing jaws in fixtures plus chain clamping, machine is fully automatic.

If you have work of this nature, consult D&T engineering for further details.

Roto-Matic

Davis and Thompson Co.

4440 N. 124th ST. MILWAUKEE 10, WISCONSIN

Handle your small part precision JIG BORING on the LINLEY JIG BORER

Why tie up your big, costly jig borers on small work when you can get maximum utility at less cost per hour on a machine exactly fitted to your work. Put your small work on the LINLEY where it belongs and reserve your large machines for large work, *where large work belongs*. You'll save money this way.

SPECIFICATIONS

Table Movement: 6" x 10" — Table Size: 7" x 17½"

Complete details sent promptly on request

LINLEY BROTHERS CO.

664 STATE ST. EXT., BRIDGEPORT 1, CONN.

2486

The Hamilton No. 1-B Precision, Small-Gear Hobbing Machine. Generates precision spur, spiral, and bevel gears, face gears, worm gears, and worms. Maximum diameter of work piece, 6"

SMALL PRECISION

Gears without tears

HERE'S WHY

The Hamilton Precision, Small-Gear Hobbing Machine, the hobber with a "reserve of accuracy," regularly holds work spindle and hob spindle run out to less than .0002", work spindle and tailstock spindle alignment to less than .0002". ***And this standard of workmanship is maintained throughout the machine.***

FURTHER

Speed, feed, and indexing each can be selected individually and independently. ***THINK*** OF THE TIME TO BE SAVED BECAUSE OF THIS ***ONE*** FEATURE!! And scores of additional features are described in our Gear Hobber Bulletin No. 2486 which we will be glad to furnish to you FREE.

IT'S A Hamilton Tool
USE IT WITH CONFIDENCE

ADDRESS

THE HAMILTON TOOL COMPANY
830 South Ninth Street
HAMILTON, OHIO

REPRESENTED IN CANADA BY
Sykes Tool Corporation, Ltd., 123/131 York Street, Toronto
Sykes Tool Corporation, Ltd., 515 Bisson Street, Montreal

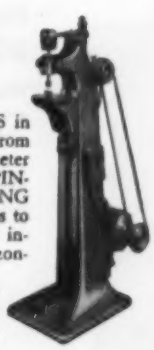
GRANT

RIVETERS — PIONEERS in their line — head rivets from smallest to ¾" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method — Sizes to meet all needs — Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.

THE GRANT MFG. & MACHINE CO.

85 Silliman Ave., Bridgeport, Conn., U. S. A.



INDEX TO ADVERTISERS

(Continued from page 153)

	Page
J & S Tool Company	137
Jacobs Mfg. Co.	129
Kearney & Trecker Corp.	138-139
King Tester Corporation	132
Landis Machine Company	10-11
Landis Tool Company	12-13
LaPointe Machine Tool Company	26-27
Lavallee & Ide Inc.	42
Linley Brothers Co.	153
Master Electric Company	54
M.B.I. Export & Import Ltd.	155
National Automatic Tool Co., Inc.	40-41
Noble & Westbrook Mfg. Co.	44
Norton Company	18-19
O.K. Tool Co., Inc.	3rd Cover
Parker-Kalon Division General American Transportation Corp.	32

AMERICAN MACHINIST
ADVERTISING SALES STAFF

Atlanta 3 . . . M. H. Miller, 801 Rhodes-Haverty Bldg., Walnut 5778
Boston 16 . . . J. H. Koch, 350 Park Square Bldg., Hubbard 2-7160
Chicago 11 . . . W. J. Haring, Bayard Nicholas, 520 N. Michigan Ave., Mohawk 4-5800
Cincinnati 8 . . . R. H. Anderson, 1110 Delta Ave., East 1-6110
Cleveland 15 . . . Gifford W. Plume, Jr., R. H. Anderson, 1510 Hanna Bldg., Superior 1-7000
Dallas 2 . . . G. L. Jones, Jr., Adolphus Tower Bldg., Prospect 5064
Detroit 26 . . . W. J. Reichard, 856 Penobscot Bldg., Woodward 2-1793
Los Angeles 17 . . . H. L. Keeler, 1125 West Sixth St., Madison 6-9351
New York 36 . . . G. H. Krimsier, J. F. Juraschek, 830 W. 42nd St., Longacre 4-3000
Philadelphia 3 . . . J. P. Tiebout, Architects' Bldg., 17th & Sansom Sts., Rittenhouse 6-0670
Pittsburgh 22 . . . K. Reeves Cook, 919 Oliver Bldg., Atlantic 1-4707
St. Louis 8 . . . Bayard Nicholas, 3615 Olive St., Continental Bldg., Jefferson 5-4067
San Francisco 4 . . . R. C. Alcorn, 68 Post St., Douglas 2-4600
England . . . Herbert Lagler, McGraw-Hill House, 95 Farringdon St., London, E. C. 4

INDEX TO ADVERTISERS

	Page
Perkins Machine & Gear Company	140
Pipe Machinery Company	39
Portage Machine Co.	34
Randall Co., Inc., Frank E.	143
Reed Rolled Thread Die Company	45
Ruthman Machinery Company	144
Ryerson & Sons Inc., Joseph T.	104
Sheffield Corp.	100
Springfield Machine Tool Co.	36-37
Starrett Co., L. S., The	46-47
Taft-Peirce Mfg. Company	24-25, 30-31
Tannewitz Works, Inc.	142
Texas Co.	58
Timken Roller Bearing Company, Steel & Tube Div.	4th Cover
Torit Manufacturing Company	139
Triplex Machine Tool Corp.	155
Van Norman Machine Co.	8-9
Verson Allsteel Press Co.	98
Warner & Swasey Company	22-23
Webber Gage Co.	136

CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 150

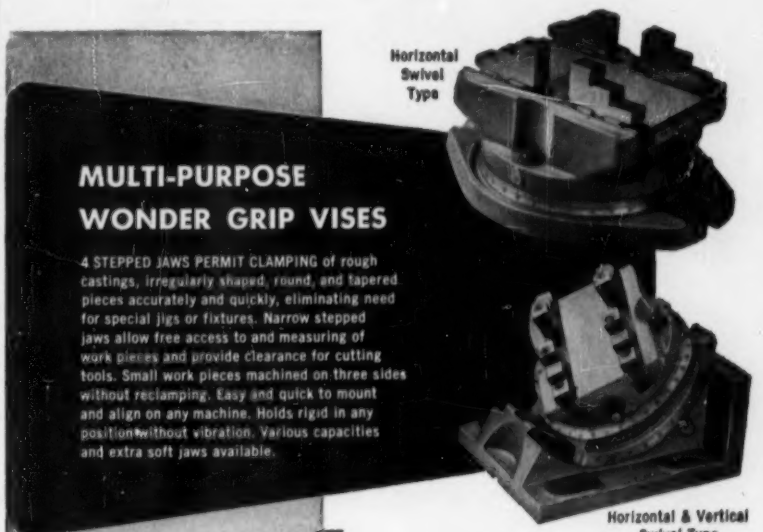
EDUCATIONAL
Books 150

EQUIPMENT
(Used or Surplus New)
For Sale 146-150

WANTED
Equipment 150

ADVERTISERS INDEX

AAA Products Co. 148
Albert Tool & Gage Co. 148
Bennett Machinery Co. 149
Brownell Machine Tools, Inc., Hazard 149
Dony, D. E. 147
Eastern Machinery Co. 148
Falk Mill Supply Co. 147
Hill-Clarke Machinery Co. 147
Hyman & Sons, Joseph 148
Laurens Bros., Inc. 149
Machine Tool Publications 150
McDonald Machinery Co. 148
Miles Machinery Co. 148
National Machinery Exchange 149
Noll Equipment Co. 149
Press & Shear Machinery Corp. 147
Republic Machinery Co. 150
Tilp, J. G. Inc. 148, 150
United Machinery & Tool Corp. 146
Wheeler Manufacturing Corp. 150



MULTI-PURPOSE WONDER GRIP VISES

4 STEPPED JAWS PERMIT CLAMPING of rough castings, irregularly shaped, round, and tapered pieces accurately and quickly, eliminating need for special jigs or fixtures. Narrow stepped jaws allow free access to and measuring of work pieces and provide clearance for cutting tools. Small work pieces machined on three sides without reclamping. Easy and quick to mount and align on any machine. Holds rigid in any position without vibration. Various capacities and extra soft jaws available.

TAPPING ATTACHMENTS

Reversible safety tapping attachments with adjustable graduated friction drive, hardened, ground and lapped, complete with torque bar and handles. Precision made throughout by long established reputable West German factory.

DISTRIBUTOR INQUIRIES INVITED

Also United States Distributors of European Machine Tools

Tested for Performance to High Amer. Standards
Immediate Delivery from N.Y. Stock
MADE IN GERMANY
Low Competitive Prices

- Quick Change Chucks and Collets
- Wille-Grip Keyless Drill Chucks
- Milling Machine Arbors, Adapters, Arbor Spacers and Bearings
- Lathe Mandrels

Our Headquarters in New York City
Write for complete details and prices to Dept. 20

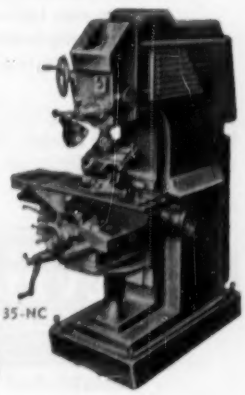
M.B.I. EXPORT & IMPORT LTD.
A Division of Machinery Builders Inc.
475 Grand Concourse, Bronx 51, N. Y.
"Over 20 years experience in designing and building machinery"
CABLE ADDRESS: Machbuild New York
Phone: MOtt Haven 5-0900

NEW MODEL
TRIPLEX JIG BORER and VERTICAL MILLER

Optical positioning in 21" x 12" area.
2½ HP motor • Amer. Standard spindle nose.
100-2000 RPM infinitely variable spindle speed.

ACCURATE • VERSATILE • DEPENDABLE

for full details write to



TRIPLEX MACHINE TOOL CORP.
75 West St., New York 6, N.Y. HAnover 2-4520

Cleveland Drum Type Clutch
speeds die adjustment . . . cuts production costs

These Cleveland Two-Point Presses equipped with patented Cleveland Drum Type Friction Clutch have done just that. You'll find that even the largest Cleveland Press equipped with a Cleveland Clutch is as easy to control as the smallest inclinable.

Press slide can be exactly "inched" for faster die adjustment or can be operated on a single stroke or continuous cycle with instantaneous starting and stopping. Operators have positive control at all times. Increased slide control extends die life . . . reduces stamping rejects.

Designed with a minimum number of moving parts, there's less chance of failure with a Cleveland Clutch. When necessary, adjustments can be made right on the press. Light-weight construction reduces horsepower required for operation. Spring-loaded brake stops slide immediately in event of electric or air supply failure. To prevent die damage, clutch can be set to slip under overload.

Install Cleveland Clutches on your older press equipment regardless of make or model. You'll get increased efficiency for lower production costs. Write or call today.

Eleven types of Cleveland Presses assure unbiased recommendation.

THE CLEVELAND PUNCH & SHEAR WORKS CO.

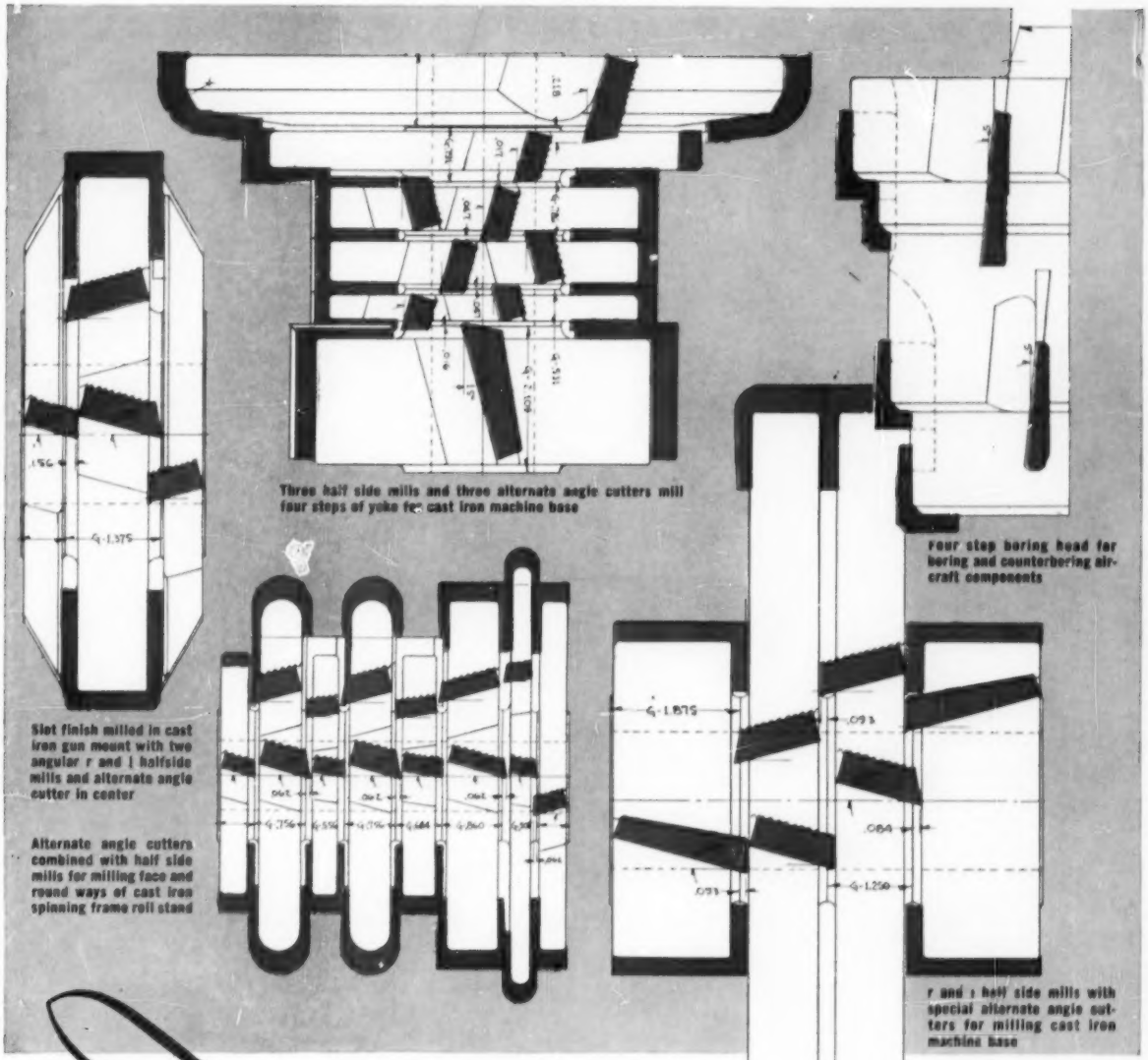
Established 1880

POWER PRESSES – FABRICATING TOOLS

E. 40th & St. Clair Avenue, Cleveland 14, Ohio

Offices at: NEW YORK · CHICAGO · DETROIT
PHILADELPHIA · E. LANSING

CITY FOUNDRY DIVISION · SMALL TOOL DEPARTMENT


Three half side mills and three alternate angle cutters mill four steps of yoke for cast iron machine base
Four step boring head for boring and counterboring aircraft components
Slot finish milled in cast iron gun mount with two angular r and l halfside mills and alternate angle cutter in center
Alternate angle cutters combined with half side mills for milling face and round ways of cast iron spinning frame roll stand
r and l half side mills with special alternate angle cutters for milling cast iron machine base

Free - 50p Book

engineering data
tooling specifications
and helpful information

This book of fifty O K Tool prints shows how leading manufacturers in aircraft, automotive, electrical and machinery industries meet rising production costs with *new multidiam boring heads* and *milling cutters* — new tools that do up to eight and ten metal-removing operations with a single stroke of the machine or one pass of the tool.

Special heads bore and face at four levels, chamfer some holes, all in a few minutes. Savings in man hours and machine time can be reduced to one-sixth of the previous cost.

Fresh from the press and now released for the first time, this book is an inspiration to engineers, designers, methods and production men. IT'S FREE!

OK modern milling cutters for modern milling machines

O K TOOL COMPANY 400 Elm St. Milford, N. H.

Please send me a copy of OK's new multidiam tool book

name _____

title _____

firm _____

street _____

city _____ state _____

products manufactured _____

_____

employees _____

Equipment: how many boring mills _____

milling machines _____ lathes _____

planers _____ shapers _____

How to make your automatic machine tools even more automatic—at no extra cost

CONTINUOUS production is what makes your automatic machine tools profitable. Every time you have to stop them to make an adjustment or a change in setup, you reduce their potential. This puts greater demands than ever on the uniformity of the steel you machine. And the more uniform your steel machines, the more automatic your machine tools become.

You can get the ultimate in uniformity at no extra cost by using Timken® fine alloy steel. Timken steel is uniform from bar to bar, heat to heat, order to order. Here's why:

We use the industry's first direct-reading spectrometer to insure uniform grain size and to control chemical composition right up to the time each heat is tapped.

We adjust our conditioning procedure to suit your machining requirements. Your order is handled individually. Each bar is stamped to identify the heat it came from. Uniformity is constant from bar to bar and heat to heat.

To make your automatic machine tools even *more* automatic—and at no extra cost—specify Timken steel machining bars. They machine the same time after time after time after time. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING